

JANUARY • 1955

PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

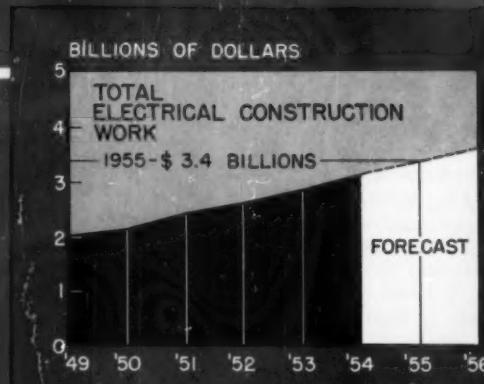


Trans-illuminated electric ceiling
lights new "glass box" bank build-
ing on New York's Fifth Avenue.

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Winners in Electrical Construction
and Maintenance's 1954 Lighting
Competition.

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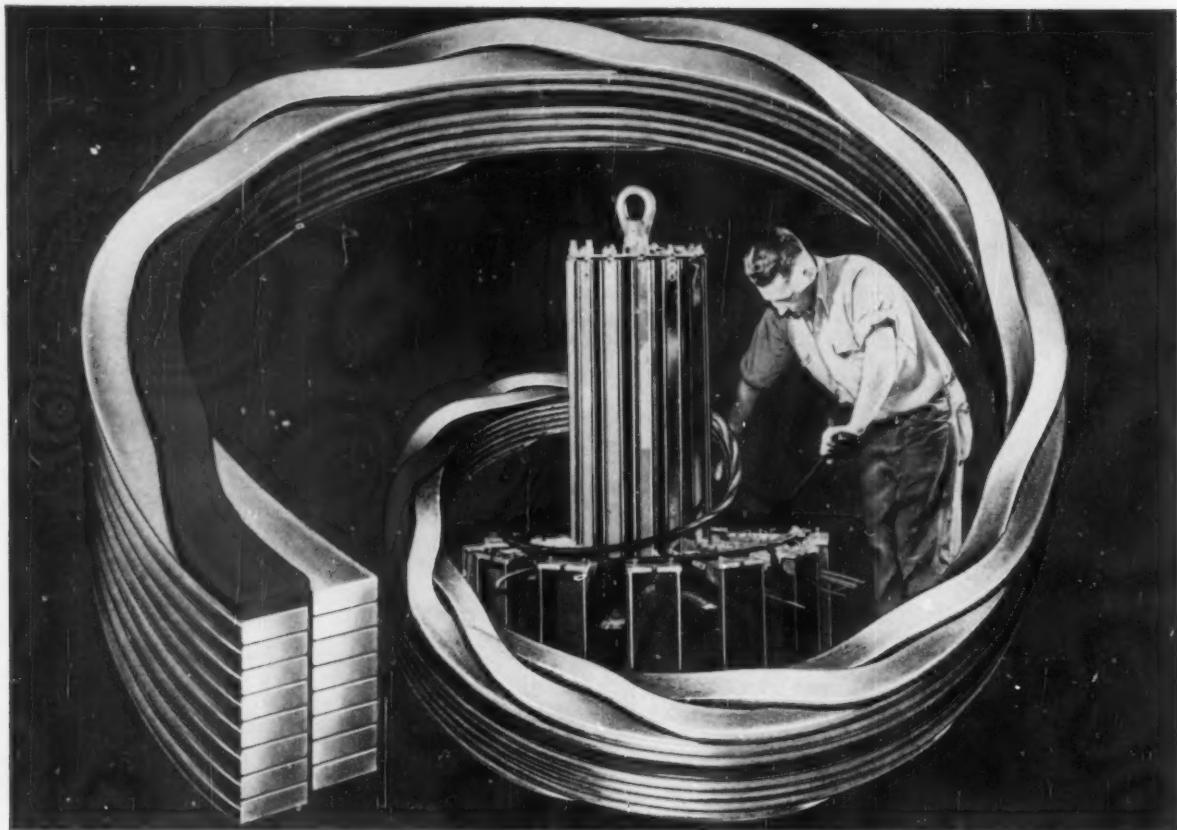


Outlook for '55. A special report on
electrical prospects for the coming
year.

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A McGRAW-HILL PUBLICATION

54TH YEAR



G-E CURRENT-LIMITING REACTORS have continually transposed rectangular conductors that result in a better conductor space factor.

5 good reasons for buying G-E reactors

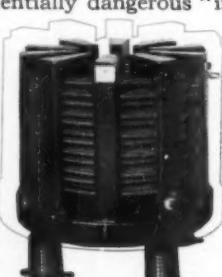
- 1. LONG LIFE** Non-aging concrete supports maintain proper electrical clearances between turns. General Electric reactors do not rely on conductor coverings of aging types for turn-to-turn insulation.
- 2. COMPACTNESS** Rectangular transposed conductors, an exclusive G-E feature, permit better conductor space factor—decrease volume of reactor by as much as 20%. Reactors fit in smaller places, save floor space.
- 3. PROTECTION** Non-aging glass tape on the conductor serves as a barrier to prevent foreign objects from causing turn-to-turn short circuits.
- 4. AVAILABILITY** Thanks to our "repetitive-manufacture" production methods, we can meet any reasonable reactor shipment requirements.
- 5. ECONOMY** Save 10% by specifying reactors with aluminum conductors. The same high-quality

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HERE ARE ADDITIONAL FEATURES:

Wet steam curing of concrete assures full strength at shipment—eliminates potentially dangerous "in-service" curing. Black phenolic varnish finish is smooth, flameproof. Metal housings, complete with entrance and exit provisions, minimize stray currents and protect personnel.

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But Adaptabel's claim to perfection doesn't rely on ringing abilities alone! Design-wise, no moving contacts or springs—together with automatic compensation for plunger wear—means literally years of dependability and trouble-free performance! Adjustments are rarely needed.

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Adaptabels are available in 4, 6, 10 inch sizes—your choice depending upon the noise level to be overcome. All-metal die cast housings... complete range of accessories include a substitute slotted gong where muting is required—full cast grids for areas where gong may be subjected to unusual impact—handsome re-



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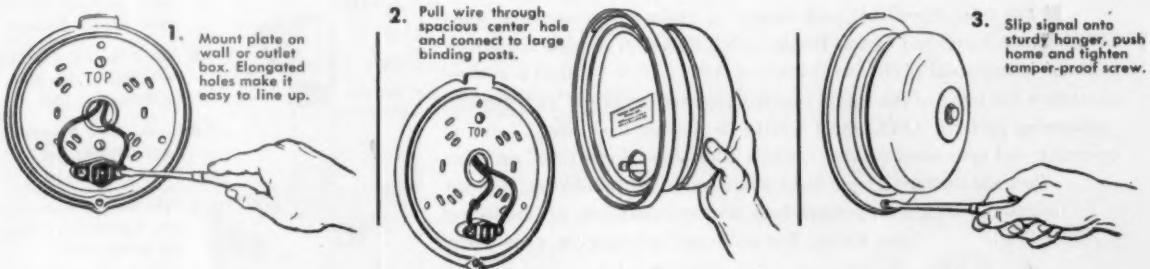
Edwards No. 340 AC Adaptabel

size	decibels*	loudness units
4 inch	77	13,500
6 inch	83	21,400
10 inch	89	35,000

*Listed by Underwriters' Laboratories.

cessed mountings where flush mounting is a factor—outside weatherproof mountings that are absolutely impervious to the elements!

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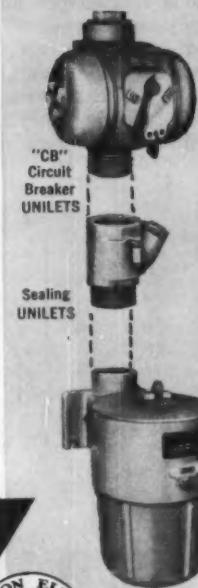
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APPLETON Motor Starter UNILETS installed on jacket water and gas coolers, Engine Room No. 2, Main Line Booster Station of Permian Basin Gas Co., Spraberry, Texas.

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- Combinations Meet U. S. Requirements through Approval of Components
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ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electrical and Electrical Record. Established 1901.

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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*Licensed under Patent 2568095 March 4, 1952 and App. No. 308710, Sept. 9, 1952.



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ENGINEER: Moody & Hutchinson

ELECTRICAL CONTRACTOR: Cates & Shepard Company

DISTRIBUTOR: Rumsey Electric Company

FIXTURES: Litecontrol #9024, 2-lamp recessed fixtures using Holophane #9033 and #9034 lenses

CEILING HEIGHT: 8'-6"

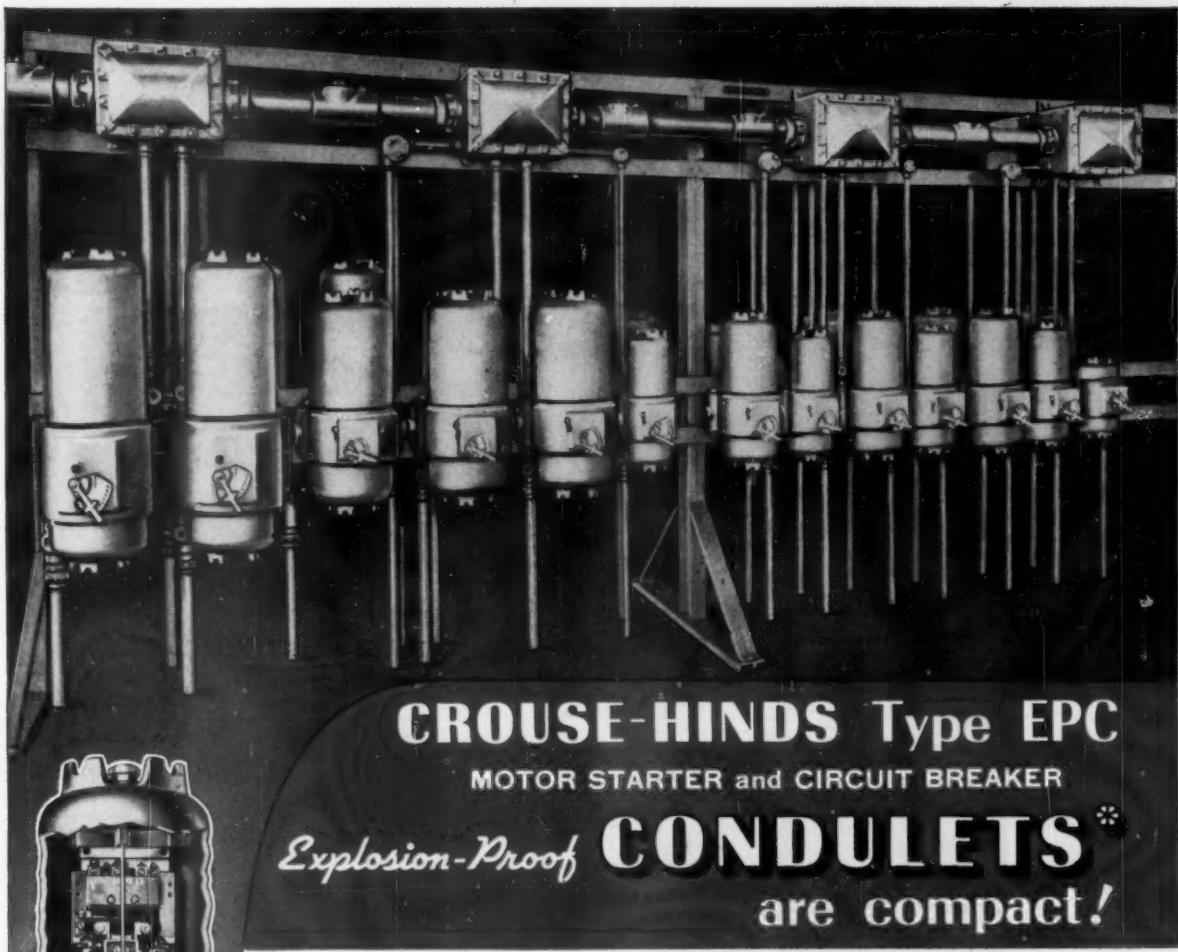
SPACING: 7'-0"

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- The Crouse-Hinds Type EPC advantages all add up to **lower installed cost and lower maintenance cost.**

Type EPC Combination Line Starter Conduit with Broken-Away Covers Showing Interior Starter and Circuit Breaker Assembly



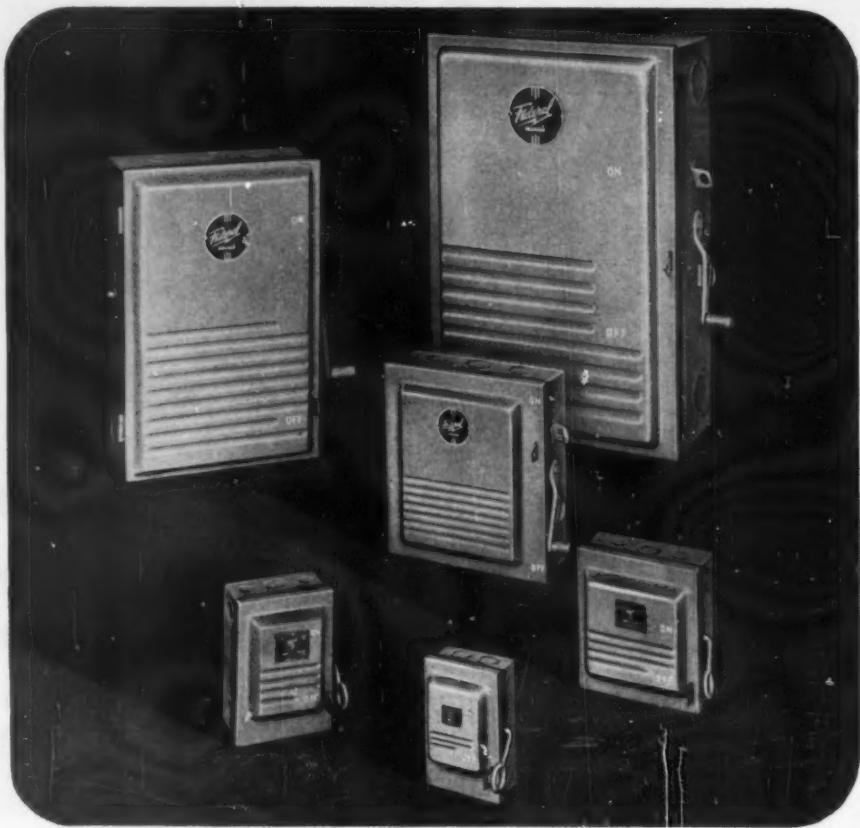
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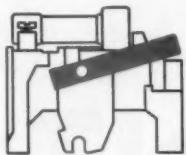
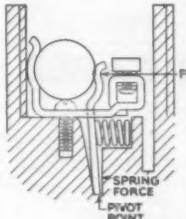
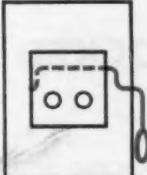
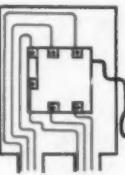
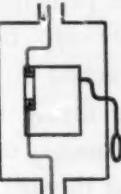
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Add these up and you will agree that the new feature-packed Federal Noark Type D Safety Switch line is the one for you. And remember... many of these advanced features are incorporated in the 60, 100, 200, 400 and 600 amp. switches.

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*For Further Information
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KILLARK Alumalloy FITTINGS

Solve Corrosion Problem

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January 14, 1954

Killark Electric Manufacturing Co.
3940 Easton Avenue
St. Louis, Missouri

Attention: Mr. James Grindell, Sales Manager
Dear Mr. Grindell:

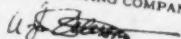
We believe you will be interested in learning of the very excellent results we have experienced using Killark electrical fittings in our operation of a magnesium reclamation and alloying plant. We had encountered serious corrosion problems which were caused by the fluxes and chemicals used, and the nature of these problems was two-fold.

First, there is a combination of sulfur dioxide with moisture in the air to form probably sulfuric acid, together with this, there is present in the room air varying amounts of hydrochloric acid created by hydrolysis of commercial fluxes used with magnesium. These two, while being well below toxic values, cause corrosion to ferrous metals. In addition, the thermal air currents deposit the above mentioned fluxes on structures of all kinds. These materials are hygroscopic, and since they are principally magnesium chloride, they form acid solutions with water from the atmosphere.

As a result of these corrosive actions, we were not able to maintain electric lines in safe operating condition for periods over six months. Conduit, fittings, terminal boxes, pull boxes and attachment screws would all corrode so severely that we would pick up moisture from the surrounding hygroscopic chemicals and short out the lines. This was true with thin-wall and rigid conduit and fittings and with both cadmium and zinc plating and with various types of paints and coatings.

Since applying the Killark aluminum fittings along with aluminum conduit, we have experienced no failures for approximately a year, and upon examination there is no indication that corrosion is progressing. We are confident that we have arrived at a practical solution.

Very truly yours,
APEX SMELTING COMPANY


A. J. Peterson,
Vice-President,

... and the next time you make an electrical connection in an industrial atmosphere of corrosive fumes or acids, or one of excessive moisture or humidity — be sure to remember the name KILLARK. You'll be mighty glad (and so will your client) that you allowed for the extra margin of safety and the added years of life that Killark fittings and fixtures offer: they can't corrode — or rust . . . they're made of sturdy, exclusive Alumalloy, the twentieth century metal! Lightweight, too . . . safe and non-sparking . . . roomier for easier splicing.



Killark

"Killark . . . a fitting name to remember"

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Kennecott's new adequate and what it means to the Electrical Contractor!

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Yet, today, more than 80% of all homes in America are underpowered . . . underwired. Their wires are too small, their circuits too few to carry the needed current. Modern, ever-increasing appliances have simply outstripped wiring systems never designed to service them!

Why don't all these homeowners rewire? You know why! The average person doesn't even recognize the symptoms of weak wiring in his home, or know what to do about them!

People just have to be *told* about adequate wiring. They must be *sold* on it. *And that's just what Kennecott's national adequate wiring campaign is doing for you!*

It's a campaign of more than 100 million hard-hitting messages now appearing in the pages of The Saturday Evening Post and This Week magazines. It's telling your prospects, your customers, the facts of electrical life and how to live it best. *What's more, every single advertisement sells your services . . . tells people to "call in an electrical contractor"!*

FREE Sales Tools!

Reprints, poster-sized blow-ups of powerful Kennecott ads, newspaper mats. *Plus* — Two brand-new weapons in the fight for better wiring: 16-page booklet, "The ABC of Home Wiring" and king-sized wall chart showing typical home wiring loads and circuits! Write Kennecott Copper Corporation, 161 East 42nd St., N. Y. 17, N. Y.

Kennecott
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For companies that supply tape to many workers for varied jobs, it's the best buy. "Tape-saver" size, we call it. It's enough for the average job . . . footage of "lost" tape is kept low. Workers like the small size, too. It "swings" easy in tight places. And remember, you start saving the minute you say

GOLD SEAL plastic tape

It gives you the many plastic tape advantages, with the plus of proved Gold Seal quality. With the warranty of Jenkins Tape specialists, you can be sure it will speed the job, stick right, and stand up under toughest conditions. Try it . . . sample free on request. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

JENKINS

Gold Seal Tape
FRICTION • RUBBER • PLASTIC



Gold Seal Plastic Tape — single 60 ft. rolls in round metal cans and Handy Pack of ten 20 ft. rolls.



Single rolls and 10-roll containers.
Also Diamond Seal Friction and
Rubber Tapes made to ASTM
Specifications. Products of Jenkins Bros.,
makers of famous Jenkins Valves.



AN HYDREX

*The cable
with the built-in Galoshes..*

Snow, slush, and rain call for galoshes. You might catch pneumonia if you leave them home. Your power cables need galoshes, too. They can't catch pneumonia, but if they get wet enough they'll eventually need expensive doctoring. • Simplex-ANHYDREX Cable has those galoshes. They're built-in in the form of Anhydrex insulation. Anhydrex insulation is guaranteed not to absorb more than 20 milligrams of distilled water per square inch after 7 days' immersion in 158° F. (70° C.) water. It is the most stable rubber insulation when exposed to water and moisture. • Besides its notable low water-absorption characteristics, Simplex-ANHYDREX Cable is unaffected by summer heat and winter cold. It won't crack under vibration and is highly resistant to acids, flame, grease, and oil. • Your Simplex representative has more information about the cable with "the built-in galoshes" — Simplex-ANHYDREX Cable. Ask him about it.

Simplex-ANHYDREX

SIMPLEX WIRE & CABLE COMPANY

79 Sidney St., Cambridge 39, Massachusetts

"The Lower Temperature Rise of FUSETRON FUSES Solved a Serious Shutdown Problem for Us"



J. F. Getz

Chief Engineer,
University of Denver
Denver, Colorado

"The fine, new Field House we built in 1949 included an ice skating rink. The ice making equipment uses two 3 phase, 220 volt, 100 hp., compressor motors having a running current of 246 amperes.

"Ahead of the magnetic starters for these motors were two 400 ampere safety switches originally equipped with 400 ampere renewable fuses.

"Shortly after the compressors went into service heat began developing in the safety switches. The fuses were running very hot — in fact to such a degree that the links in the fuses were melting and causing as many as three shutdowns a week.

"In August of 1951 I saw a demonstration by a BUSS representative that showed how much cooler was the operating temperature of Fusetron fuses.

"Right then, I determined to try out Fusetron fuses in these two switches. To get better protection I dropped the fuse size down to 300 amperes.

"With the installation of Fusetron fuses the heating immediately disappeared and so did the shutdowns it formerly caused.

"The lower temperature rise of Fusetron fuses solved a serious shutdown problem for us."



**YOU TOO, CAN MINIMIZE PLANT SHUTDOWNS AND EQUIPMENT LOSSES BY
INSTALLING FUSETRON FUSES — THEY
GIVE 10 POINT PROTECTION**

- 1 Protect against short-circuits.
- 2 Protect against needless blows caused by harmless overloads.
- 3 Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
- 4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.
- 5 Protect motors against burnout from overloading.
- 6 Protect motors against burnout due to single phasing.
- 7 Give DOUBLE burnout protection to large motors — without extra cost.
- 8 Make protection of small motors simple and inexpensive.
- 9 Protect against waste of space and money — permit use of proper size switches and panels.
- 10 Protect coils, transformers and solenoids against burnout.

Model 41 Unconditionally Guaranteed



eliminate switch failures with
THE SWITCH THAT'S always READY

Pampered in production to withstand abuse in use, the Levolier® #41 switch retains its positive action even after hundreds of thousands of pulls. It is unconditionally guaranteed against failure in lighting circuits. Its one-piece molded phenolic case insures better insulation, makes wiring easier. Removal of the mounting nuts lets the mechanism slip out, exposing terminals. A 6 amp "T" 125 volt switch, it is only $\frac{5}{8}$ " x $1\frac{1}{8}$ " x $1\frac{1}{8}$ ". Ideal for individual control of lighting fixtures.

4300-PB

4100



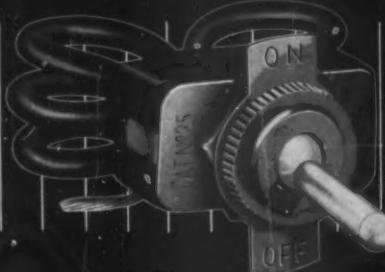
NEW

Industrial LAMPHOLDERS* with
Levolier® Switch Dependability

Whether you prefer universal lever or the new push button control, you can have a Levolier Lampholder that has a proven record of long service in strenuous industrial use. Levolier switch mechanisms are built into both brass and molded phenolic heavy duty lampholders in a variety of single or two circuit models. All are built to eliminate failures in plant and machine lighting that can mean costly production time losses.

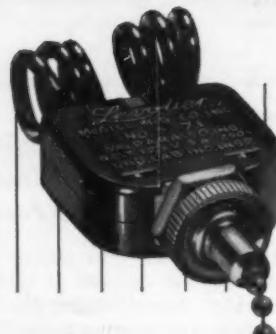


Levolier® No. 25



Specify *Levolier* for
Dependability in Toggle Switches

The Levolier® No. 25 Toggle Switch is "T" rated for 6 amps — 125 volts and especially dependable for FHP motors on quality appliances, portable tools and for panel boards. Only $\frac{1}{2}$ " thick, $\frac{1}{2}$ " wide and 1" long. The molded phenolic case is dust and vibration proof. 6" wire leads with choice of colored levers for easy identification of circuits. Available also in three way and two circuit models with lugs or screw terminals.



For FASTER, EASIER WIRING specify
Levolier® No. 71 switches

A single pole, single circuit switch, the Levolier® No. 71 model is the thinnest 6 amp "T" 125 volt switch on the market today. Only $15/32$ " thick, it insures quicker and easier installation because of the 6" wire leads that are permanently fastened to the terminals by pressure connections. Standard finishes: brass, dark bronze and burnished nickel, with brown molded phenolic case. The No. 71, like all Levolier switches, is Underwriters' approved.



YOU CAN DEPEND ON
McGILL®
QUALITY

Available through leading Electrical Wholesalers
For complete information on products of the McGill
Electrical Division, write today for Catalog No. 49-A.



McGILL MANUFACTURING COMPANY, INC.
450 N. Campbell St., Valparaiso, Indiana

You can increase production at night by using Crouse-Hinds Floodlights to

"turn night-time into day-time"

Production curves go up when Crouse-Hinds high efficiency floodlights are installed in yards and approaches to industrial plants.

The usefulness of many outdoor areas can be multiplied by flooding them with controlled illumination. Crouse-Hinds all-inclusive line with short, medium, and long range projectors makes it possible to get the right amount of light at the locations where it is needed. This control insures the clarity of daylight where it will do the most good, without wasteful over lighting of unused areas.

Frequently it will cost much less to project light a considerable distance with Crouse-Hinds long range floodlights than to run cable and install local lighting. There are also indoor locations in large buildings where floodlights are the most economical and satisfactory source of light.

Plenty of light is also the most reliable and cheapest form of protection against night prowlers. Sabotage and pilferage thrive in darkness. Crouse-Hinds floodlights project powerful beams of light that bathe all approaches to your property with glaring radiance, compelling everyone to be more visible than in broad daylight.

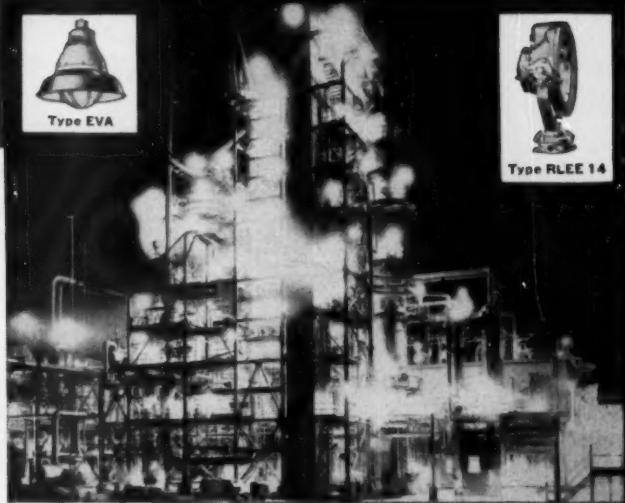
A Crouse-Hinds floodlighting installation pays off in: (1) increased production; (2) prevention of accidents; (3) protection against dangerous prowlers. Pioneers in floodlighting, Crouse-Hinds illumination engineers have accumulated a wealth of lighting knowledge that is at your service. Write for additional information and ask for your FREE copy of Crouse-Hinds Bulletin 2672 "Lighting Equipment". It contains listings of hundreds of types and sizes of floodlights and explosion-proof, dust-tight, and vaportight industrial lighting fixtures.

CROUSE-HINDS COMPANY Syracuse, 1, N.Y.

OFFICES: Amarillo — Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Memphis — Milwaukee — New Orleans — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — St. Paul — Tulsa — Washington
RESIDENT REPRESENTATIVES: Albany — Atlanta — Baltimore — Boston — Charlotte — Chattanooga — Corpus Christi — Denver — Fa. — Miami — New Orleans — Newark — Pittsburgh — St. Louis — Toledo — Tulsa — Wichita — Worcester
Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.



Type EVA

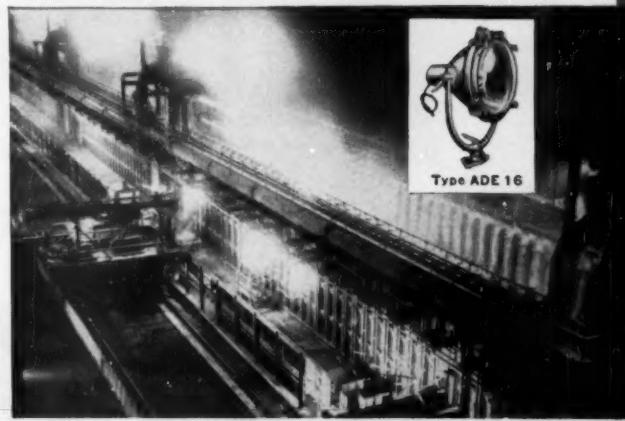


Type RLEE 14

A petroleum refinery lighted for round-the-clock operation with Crouse-Hinds Type EVA Explosion-Proof and Raintight Industrial Lighting Fixtures, and Type RLEE-14 Explosion-Proof Floodlights.



Type ADE 16



Crouse-Hinds Type ADE-16 Heavy Duty Floodlights are used to "turn night-time into day-time" at this plant for 24-hour production.



Type FLA



A parking lot efficiently lighted by Crouse-Hinds Type FLA General Purpose Floodlights.



FLOODLIGHTS • AIRPORT LIGHTING • TRAFFIC SIGNALS • CONDULETS

T. J. COPE, Inc. 711 SOUTH 50th STREET • PHILADELPHIA 43, PA.
Telephone Saratoga 9-0104

TO THE ELECTRICAL INDUSTRY:

We have served the electrical industry
through our

Development
Engineering
Field Service } of COPE Cable Trough

Utilities, industrials and municipalities
around the world have recognized, accepted
and used COPE Cable Trough in their

recent installations.

Now, in keeping with our past pioneering
spirit, we are about to announce new
developments which will greatly reduce
the cost of your future COPE Cable Trough
installations.

T. J. COPE, INC.

MANUFACTURERS • SERVING THE ELECTRICAL INDUSTRY
FOR OVER SIXTY-FIVE YEARS



WATCH FOR IT SOON IN THIS MAGAZINE

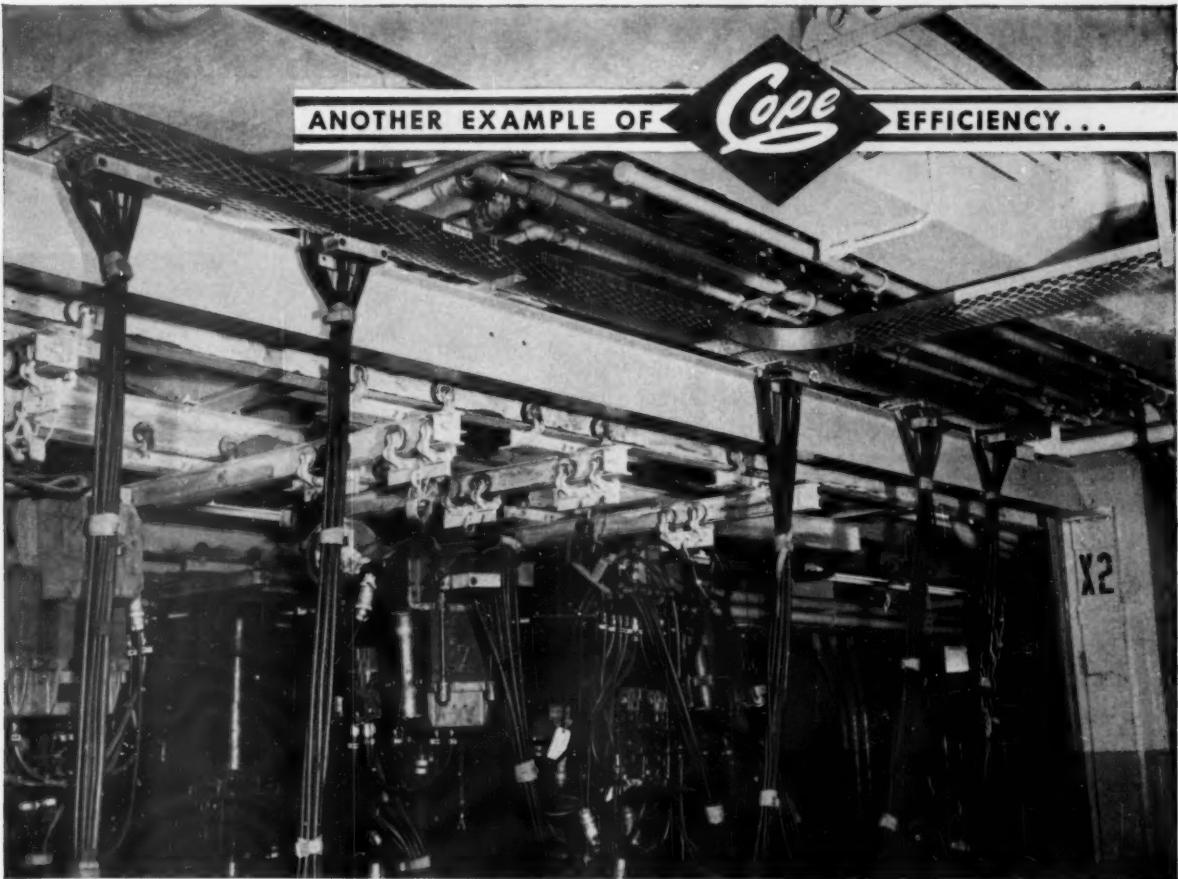


You also know Cope by these products



T. J. COPE, INC.

711 SOUTH 50th ST., PHILADELPHIA 43, PA.



Cope Cable Trough installed at the Ford Motor Company, Dearborn, Mich.

COPE CABLE TROUGH—VERSATILE, INDEED!

The photograph above shows a run of Cope Cable Trough carrying not only power cables for the overhead electric welders, but tubing for the cooling water as well! It is an excellent example of the versatility of this method of power distribution.

The low cost and the ease with which Cope Cable Trough may be installed are making it extremely popular these days as a standard system for the support of power and control cables.

And that's not all . . . the trough is available in a wide range of sizes and fittings which permit it to be quickly set up at the job site to conform to almost any plant layout.

Why not find out more about Cope Cable Trough? Write today for further information . . . Ask for Bulletin 11-EC.

You know Cope by these products



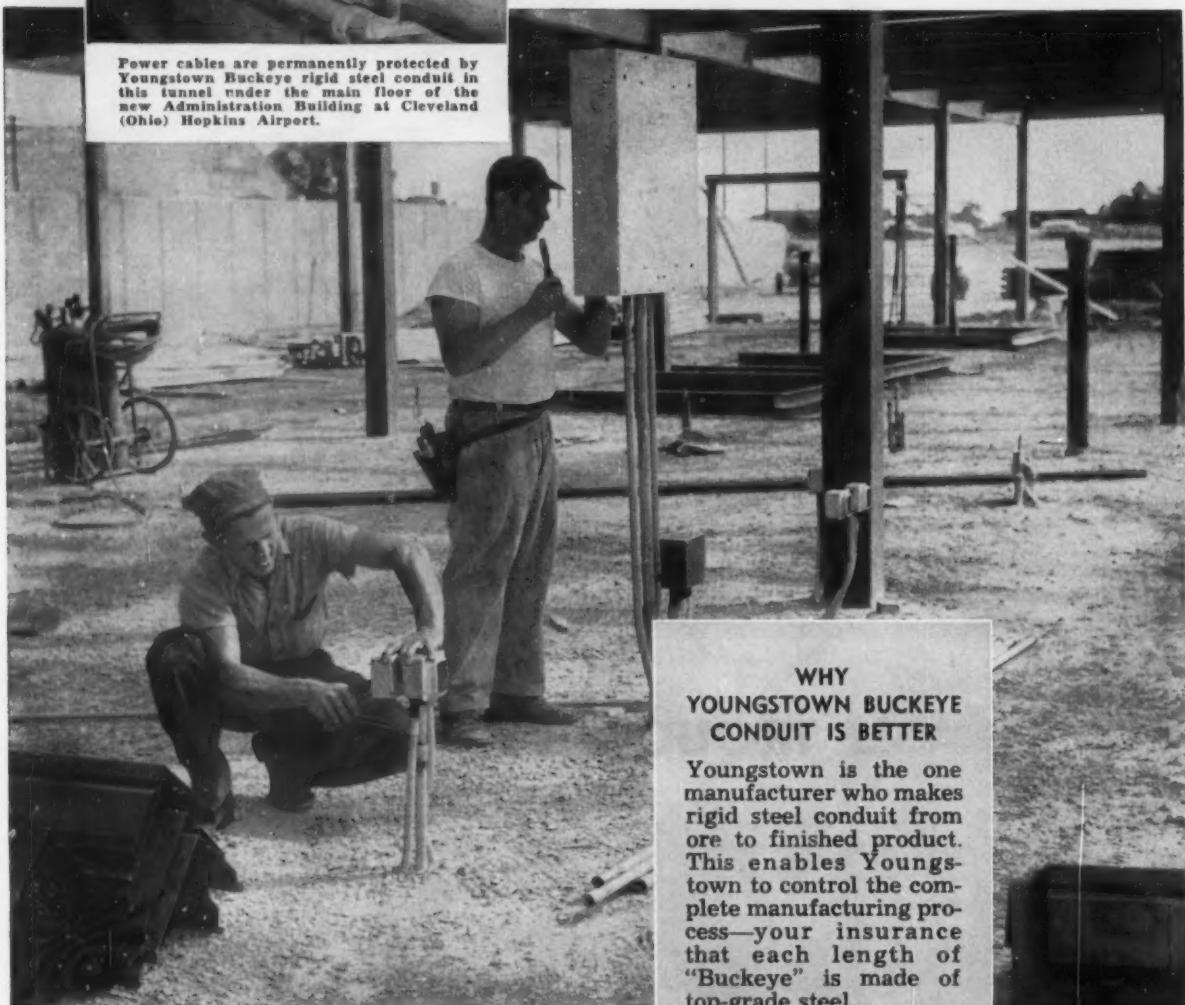
T. J. COPE, INC.



711 SOUTH 50th ST., PHILADELPHIA 43, PA.

65 tons of Youngstown Buckeye Conduit at Cleveland Airport

Power cables are permanently protected by Youngstown Buckeye rigid steel conduit in this tunnel under the main floor of the new Administration Building at Cleveland (Ohio) Hopkins Airport.



WHY YOUNGSTOWN BUCKEYE CONDUIT IS BETTER

Youngstown is the one manufacturer who makes rigid steel conduit from ore to finished product. This enables Youngstown to control the complete manufacturing process—your insurance that each length of "Buckeye" is made of top-grade steel.

Buried in these concrete floors and in tunnels—connected to pull boxes, base-plug boxes and lighting panels—are 65 tons of Youngstown Buckeye rigid steel conduit. "Buckeye" was specified for this Cleveland Hopkins Airport job because, above all, it's **SAFE** for critical wiring installations.

Youngstown



THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices: Youngstown, Ohio - District Sales Offices in Principal Cities

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

Manufacturers of
Carbon, Alloy and Specialty Steel



IT'S EASY TO SELL **Stab-lok®** TO BUILDERS (gives them a big sales point, for pennies)

ALL OVER THE COUNTRY, builders are the biggest prospects for Stab-lok Circuit Breakers. They buy Stab-loks like hot cakes because they're convinced that modern circuit protection is a really important sales point with prospective home buyers. And, of course, Stab-loks cost only pennies more than fuse boxes...and across-the-board cost less than other circuit breakers when you buy them; less to install; less when you change or add circuits.

And look at these other *exclusive* Stab-lok features:

Absolute dependability—More Stab-loks are being installed today than all other circuit breakers put together...they're the only breakers service-proven in millions of homes.

Most complete line—Stab-lok with widest range of enclosures

meets every reasonable specification for circuit protection, easily, without fuss or bother.

Most flexible—Stab-lok Magic "E" and sequenced bussing, PLUS the standard, single pole NA, the new thin NC and the double pole (simultaneous trip) breakers, provide flexibility unapproached by any other system.

Most distributors—Stab-lok distribution is completely tops; breakers and enclosures are delivered promptly—everywhere.

Sure, keep after the smaller prospects for Stab-lok—they all add up. But go after builders, too, and sales will *multiply*. And write for the Magic "E" booklet giving latest Stab-lok facts. Federal Pacific Electric Company, 50 Paris Street, Newark 5, N. J.



FEDERAL PACIFIC ELECTRIC CO.

FORMERLY—FEDERAL ELECTRIC PRODUCTS COMPANY AND PACIFIC ELECTRIC MANUFACTURING CORP.

Main Office: 50 PARIS STREET, NEWARK 1, N. J.



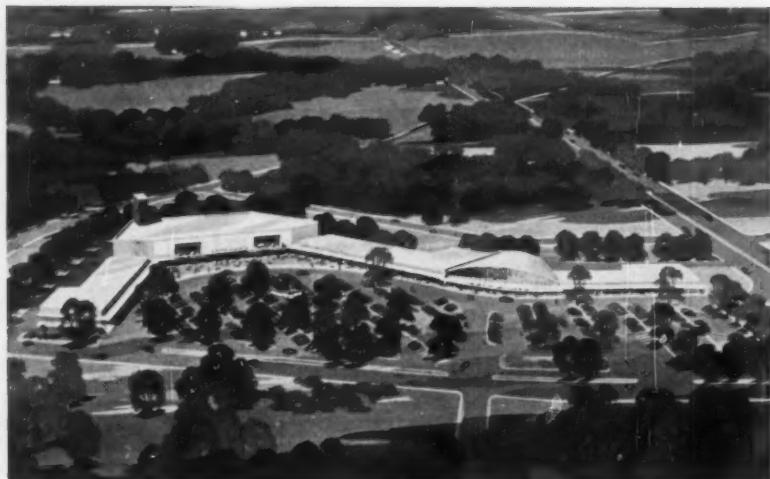
Federal Pacific products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct, High voltage circuit breakers and power switches ★ Sales offices in principal cities.



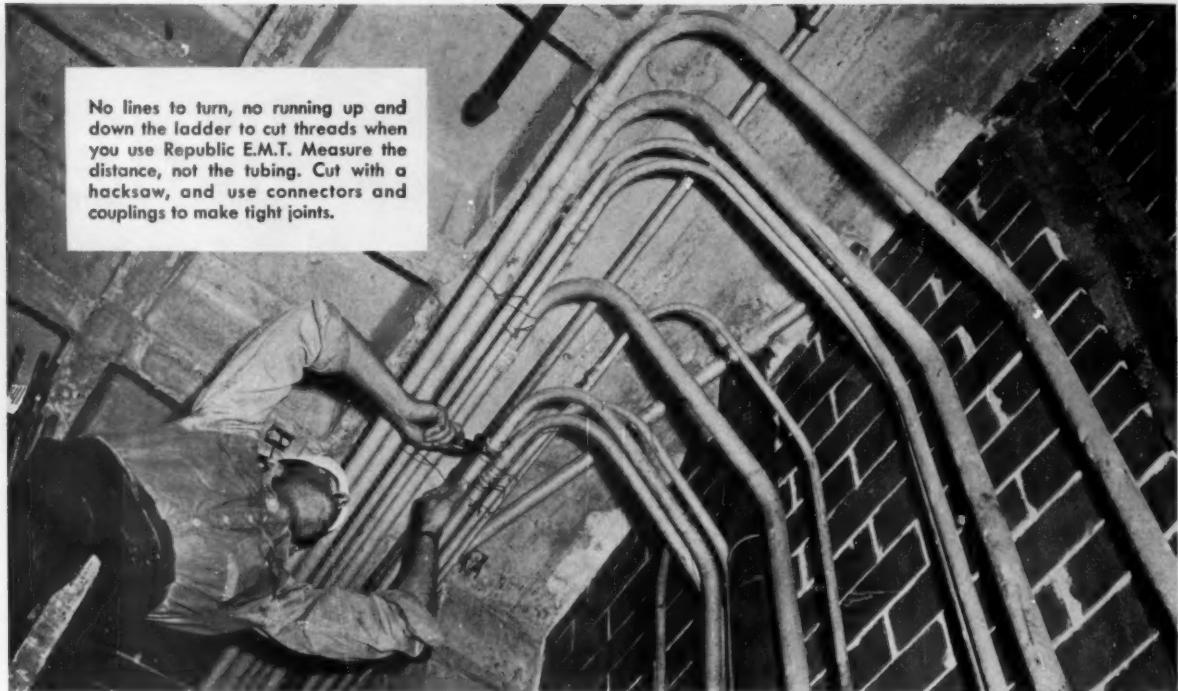
Big jobs show how



STORING CONSTRUCTION MATERIALS is easy and efficient when you use Berger Clip-Type convertible steel shelving. It's rugged, easily installed, and can be quickly re-arranged to suit changing needs. Shelves can support heavy loads.



NORMANDALE SHOPPING CENTER, MONTGOMERY, ALA. Electrical Contractor: Long & McGehee Electric Co., Montgomery, Ala. Electrical Distributor: Noland Co., Montgomery, Ala. Architect: Sherlock, Smith & Adams, Montgomery, Ala. Consulting Electrical Engineer: James L. Phillips, Birmingham, Ala. General Contractor: Jehle Bros., Inc., Montgomery, Ala. This is only one of the many large shopping centers where Republic "Inch-Marked" E.M.T. has been used.



No lines to turn, no running up and down the ladder to cut threads when you use Republic E.M.T. Measure the distance, not the tubing. Cut with a hacksaw, and use connectors and couplings to make tight joints.

you can cut waste

An estimated 170,000 feet of "light wall" conduit went into the brand new Normandale Shopping Center in Montgomery, Ala. And a lot of it was Republic "Inch-Marked" E.M.T.

Why? Because this ductile steel electrical raceway cuts down on waste.

Electricians cut the tubing at the "Inch-Marks". They didn't have to measure it. They were able to make smooth, accurate bends. All they did was line up the "Inch-Marks" on the tubing with those on the Republic Calibrated Bender.

When it came to wire-pulling, Republic's exclusive inside-knurling made the job easier, allowed wires to slide without strain. "Fishing" was easier, too.

No threads to cut, either. Connectors and couplings went right over the tube to make tight joints, without turning the whole raceway. Or cutting away the galvanizing.

You can cut waste on any job. It doesn't have to be a big one. Just ask your distributor for Republic "Inch-Marked" E.M.T. And be sure you get it.

REPUBLIC STEEL

*World's Widest Range of
Standard Steels and Steel Products*



REPUBLIC STEEL CORPORATION
3146 East 45th Street, Cleveland 27, Ohio

Please send me literature on these Republic products:

Republic "Inch-Marked" E.M.T. Berger Steel Shelving

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K-7542

It takes
just a
handful



LOCK-TITE CONNECTORS

to tap... terminate... or splice
on all your jobs

Easy installation using 1
only a standard key
wrench.

Fitting operates on 2
screw-and-saddle prin-
ciple.

Built-in lock washer 3
keeps fitting tight.

Serrated saddle and 4
body for better grip.

Force applied here is 5
greatly multiplied by
leverage screw . . .
gives tight all-around
grip on cable.

T & B designed saddle
securely holds
large cables or small
cables of all types.

T & B Lock-Tite fittings are engineered for long
service . . . they cost you less to install—
be sure to use them on your next job.

LOOK FOR THIS SIGN—



LOCK-TITE LUG

One-piece design holds all kinds of conductors: solid, stranded flexible, extra flexible, hemp core, rod, and tubing. Uniform all-around pressure means high conductivity. Only 7 sizes handle all cables from #4 solid to 1000 MCM.



LOCK-TITE TEE-PARALLEL TAP

A versatile, one-piece fitting for use as a tee, parallel, elbow, crossover, two-way, or reducing connector. Hinged top hooks over the "main"...lower opening holds the "branch". Only 13 sizes connect all combinations of "main" cable (1/0 to 1000 MCM) to "branch" cables (#2 to 1000 MCM).



LOCK-TITE TWO-WAY CONNECTORS

Neat and smoothly-rounded fittings for end-to-end connections. Cables are held by individual overlapping, serrated saddles. Each connector takes several cable sizes — you can use it as a reducer. The completed joint is small, streamlined, easy to tape. Only seven sizes handle all cables from #4 solid to 1000 MCM.



TWO other handy, T & B pressure connectors

MINION JUNIOR TEE-PARALLEL TAPS

Compact, one-piece connector taps small branches to large mains. Self-adjusting jaws grip main and branch cables all around. To make a tee tap, just bend the branch wire at right angles. Installed easily with only a screw driver. Twelve sizes connect all combinations of "main" cables (#8 to 1000 MCM) to "branch" wires (#14 to #1).



LUGITS — Quickly installed terminals for small cables. Double thickness at the thread locks the screw in place. Copper tongue is serrated for positive grip on cable (sizes #14 to 4/0). Screwdriver tightened.



IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

T319

THE THOMAS & BETTS CO.

INCORPORATED

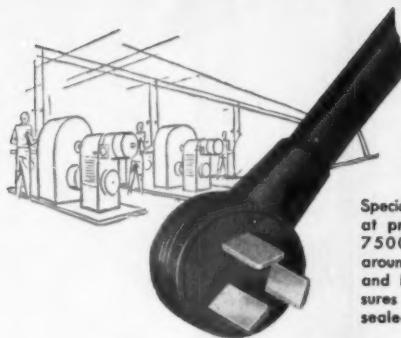
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MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

THERE IS A "RIGHT" CORD

FOR Ranges and Dryers



Injection molded

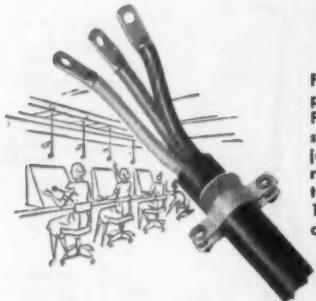
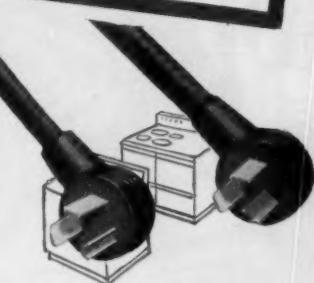
Special rubber compound, at pressures exceeding 7500⁺ p.s.i. forces around jacket, insulation and blade junctions insures dense permanently sealed rubber cap.

and here's why

It's a
PARANITE®
"SAFE" cord

plated blades

Complete Cadmium plating, from tip to conductor crimp, assures electrically superior connections, better contact surface within receptical and clean bright blades.



100% "cords" control

From rubber, compounded specially at the Paranite Mill, through stranding, insulating, injection molding, strain-reliefs, terminals, and tests, these cords are 100% inspected and UL approved.

electrically superior

Insulation Resistance between conductors exceeds 32,500 meg-ohms. (50 meg-ohms standard). Dense molded cap insures exceedingly high dielectric strength properties.



It takes specially compounded rubber, precisely controlled equipment and close supervision to injection mold these 90° angle caps . . . but look at the results! You get a firm, dense and more uniform permanently molded cap that means complete customer satisfaction.

Cadmium plating of blades is another important "extra" you get with all PARANITE Range, Dryer and Appliance Cords . . . which assures a more de-

pendable and surer electrical contact.

PARANITE Cords give outstanding performance . . . Insulation Resistance of over 32,500 meg-ohms and extremely high dielectric qualities prove their superiority.

To perfect, manufacture and 100%-inspect cords of this calibre takes extra effort . . . but PARANITE "Safe" Cords have a reputation to maintain and they must be RIGHT!

RANGE CORDS

RP-1 2 #8-1 #10
RP-2 2 #6-1 #8
RP-3 3 #6

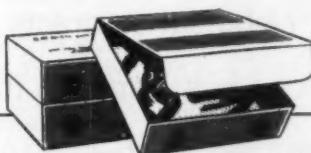
DRYER CORDS

RP-10-PG 3 #10

separately packed in sturdy cartons



If it's
PARANITE
It's right



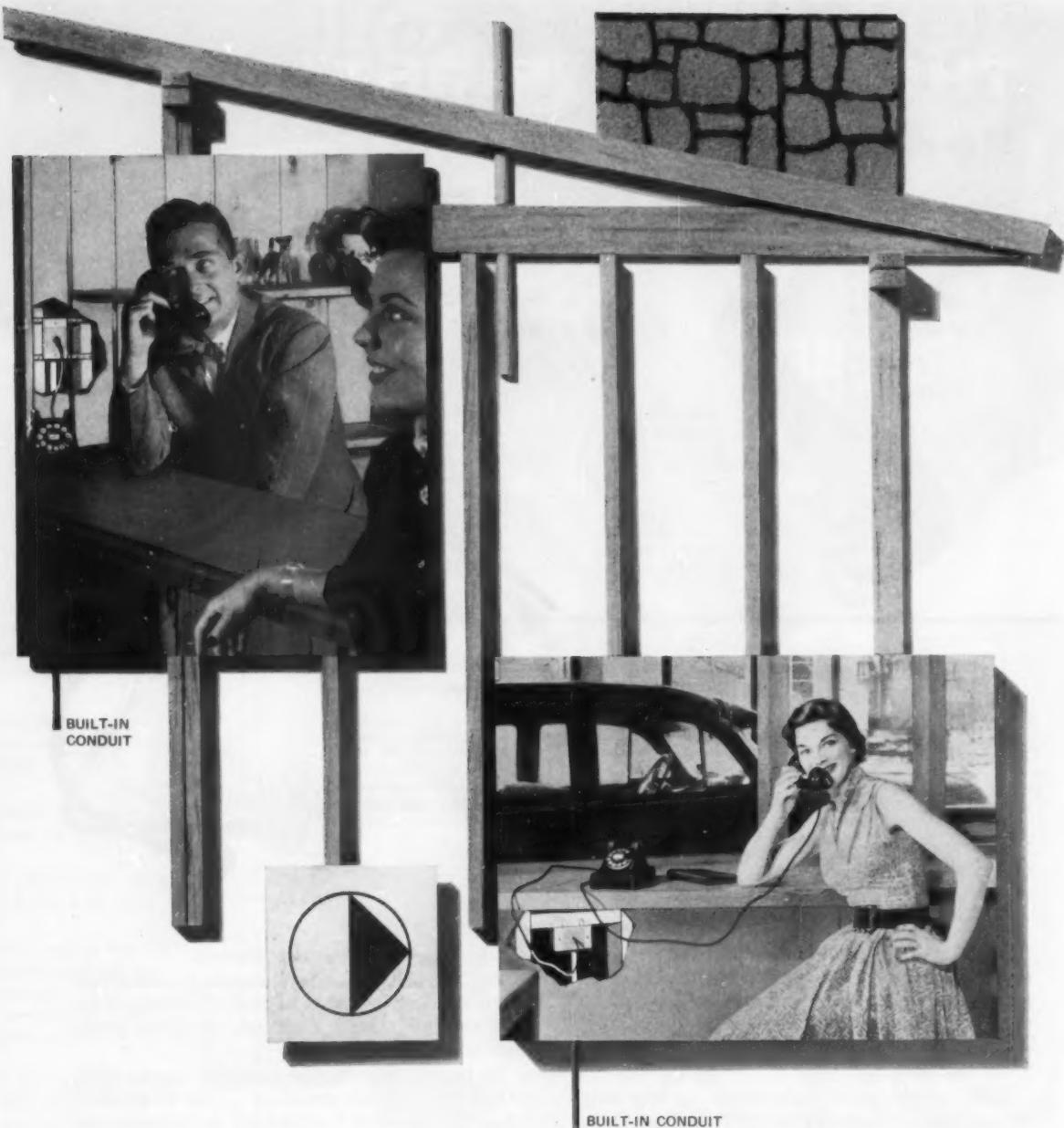
PARANITE WIRE & CABLE DIVISION • ESSEX WIRE CORPORATION
FORT WAYNE 6, INDIANA

MANUFACTURING PLANTS: Birmingham, Alabama; Anaheim, California; Jonesboro, Indiana; Marion, Indiana.

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* Saint Louis, Missouri, 3435 Chouteau Ave.
* San Francisco, California, 1077 Howard Street
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Including telephone conduits in all your electrical contracts for new homes is a profitable practice. And it means the owners will always have the telephone service they want where they want it—with telephone wires concealed.

Your Bell telephone company will be glad to help you work out economical conduit installations.

Just call your nearest business office. **BELL TELEPHONE SYSTEM**



to meet your lighting requirements . . .

^{pp} BENJAMIN **MAGNA-FLO⁹⁹**

Sold Exclusively through Electrical Distributors



1. Easy-to-clean "Life-Time" Porcelain Enamel with 85%-or-higher Reflection Factor.
2. Available with Diffuser-Reflector for Greater Upward Light.
3. Just 2 lengths of channels and 4 basic reflectors form backbone of "Magna-Flo" systems!
4. 13° Shielding minimizes lamp glare.
5. Made for 48" and 96" T12 Slimline Fluorescent Lamps . . . 2 or 3-lamp units.

No matter where you want fluorescent light . . . high ceilings or low ones, assembly lines or drafting rooms, inspection or mass-production lighting . . . there's a "Magna-Flo" System to exactly match the need. Bulletin 5705 brings you complete details. For your free copy write:

Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Ill.

CUT MAINTENANCE COSTS and RE-LAMPING TIME

with exclusive, rust-resisting, depressible, metal-clad "Springlox" Lampholders, featuring patented, instant-contact spring design.



"Look Into" the latest complete data on
FUSES
FOR EVERY PURPOSE

To help you solve confusing fuse problems, Economy Fuse & Mfg. Co. has just issued a convenient, pocket-size folder that tells you exactly the right fuse for practically any purpose. This handy folder illustrates and describes all the latest fuse developments and lists capacities, sizes, prices, etc. Electrical contractors, and commercial, industrial or domestic fuse users, can obtain copies from their electrical dealer or wholesaler. "For Fuse Economy Use Economy Fuses."

Get your free copy of this new folder

All Trademarks Reg.

ECONOMY fuses for every purpose

SOLD THROUGH ELECTRICAL WHOLESALERS SINCE 1911

ECONOMY FUSE & MFG. CO.
2717 Greenview Ave. • Chicago 14, Illinois

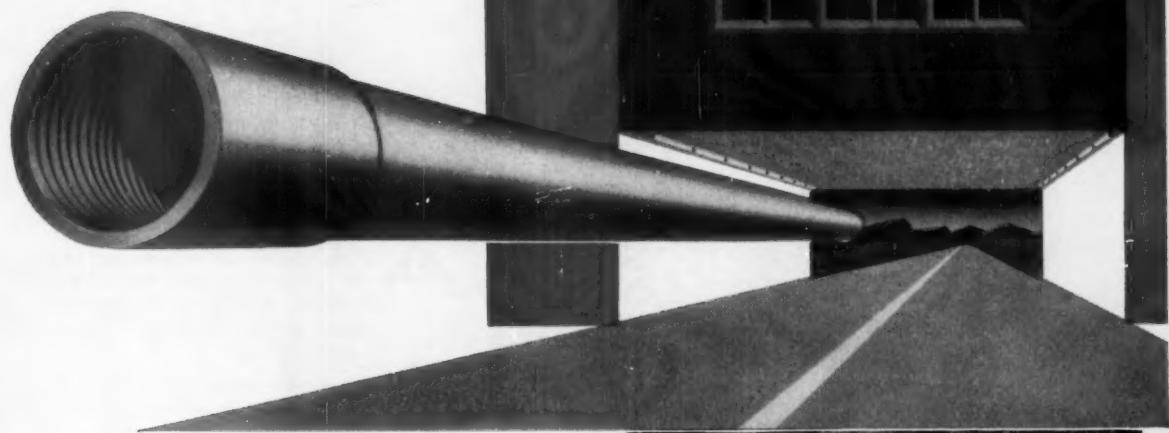
**Your Electrical Wholesaler
has ECON Dual-Element
Cartridge Fuses in stock.**

1108

SPANG®

CONDUIT

helps assure safe driving on the West Virginia Turnpike



When you're driving along a highway and suddenly enter a long tunnel, it is vitally important to your safety that the tunnel is properly lighted. To assure years of safety through dependable lighting, it is equally vital that the tunnel's wiring receives top protection.

The wiring in the 1/2-mile Memorial Tunnel on the new West Virginia Turnpike is protected by the best in conduit . . . top-quality Spang Conduit.

11,000 ft of 1½" Spang Conduit have gone into the ceiling slab for 426 regular and emergency tunnel lighting outlets. 8,080 ft of 3½" top-quality Spang are being used in one tunnel wall for high tension feeders.

Spang Conduit is easier to cut, thread, bend and weld, because the manufacture of Spang is *quality-controlled* throughout. Each length is tested and inspected before shipment.

When you're buying conduit and you want extra quality at no extra cost, be sure to specify Spang. Write for complete information and the name of your nearest Spang Distributor.



Owner:
General Contractor:
Electrical
Subcontractor:

Designing Engineers:
Supervisory Engineers:

Spang Distributor:

West Virginia Turnpike Commission
Bates and Rogers Construction Co., Chicago, Ill.

Barnes and Brass Electric Co., Clarksburg, W. Va.
Singstad & Baile, New York, N.Y.
Howard, Needles, Tammen and Bergendoff,
New York, N.Y.

Westinghouse Electric Supply Co., Clarksburg, W. Va.



SPANG-CHALFANT

Division of The National Supply Company

GENERAL SALES OFFICE:

TWO GATEWAY CENTER, PITTSBURGH, PA.

District Offices and Sales Representatives
in Principal Cities

Red Throat

B-M 21B, THE NEW INSULATED THROAT

INDENTER
CONNECTOR
FOR E.M.T.

*Four Ways
Finer*



- 1 Protruding rounded red plastic lip of bushing prevents cutting of insulation - eliminates shorts.
- 2 Full thread screws into all conduit fittings. Lip of RED THROAT bushing protects thread from damage.
- 3 Deep dished eight pronged lock nut is easier to drive on - screws flush to shoulder and digs into metal of box for vibration proof positive ground.
- 4 Permanent locked-in bushing insures smooth burr-free raceway for easy fishing. No extra work and costs no more.

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

ALL BRIEGEL FITTINGS ARE U.L. APPROVED AS CONCRETE-TIGHT

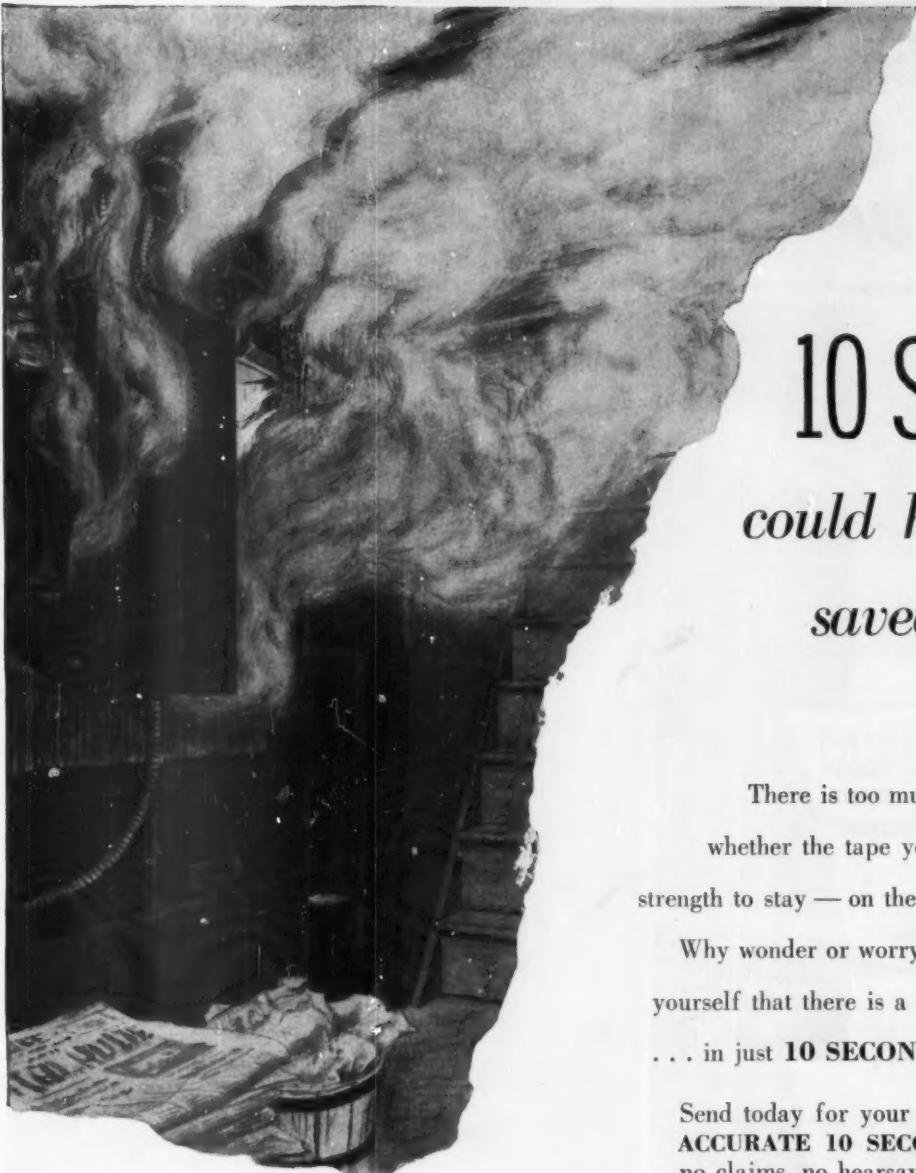
Order from Your Wholesaler!

All B-M Indenter
Fittings are U.L. Approved
as concrete-tight and for general
use (File Card E10863). Also comply
With Federal Specifications W-F-406.



BRIEGEL
METHOD
TOOL
CO.
GALVA • ILLINOIS

Warehouse Stocks in Principal Cities for Immediate Delivery!



10 Seconds could have saved \$10,000

There is too much at stake not to know whether the tape you use has the adhesive strength to stay — on the job the life of the job.

Why wonder or worry when you can prove to yourself that there is a tape that will do it in just **10 SECONDS?**

Send today for your
ACCURATE 10 SECOND TEST KIT...
no claims, no hearsay . . . the proof
is in the product for you to see.

ACCURATE



TAPE

**FRICTION TAPE
RUBBER TAPE
PLASTIC TAPE**

ACCURATE MFG. CO.
47 Hepworth Place, Garfield, New Jersey
Please send me, without obligation, an ACCURATE
10 SECOND TEST KIT.

NAME _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



WALTER D. VANCE, JR., Vice President • California Electric Co., reports:

**"We saved 14 days installing
527 fixtures by using
'UP-RIGHT' Scaffold-on-Wheels"**

Man-hour savings on this General Motors warehouse job amounted to over 40%. Up-Right Scaffold is so light it is easily assembled by one man. Individual 1 piece aluminum alloy sections are unfolded and set one on top of the other. They lock into place instantly.

14' tower
assembled in
2 minutes

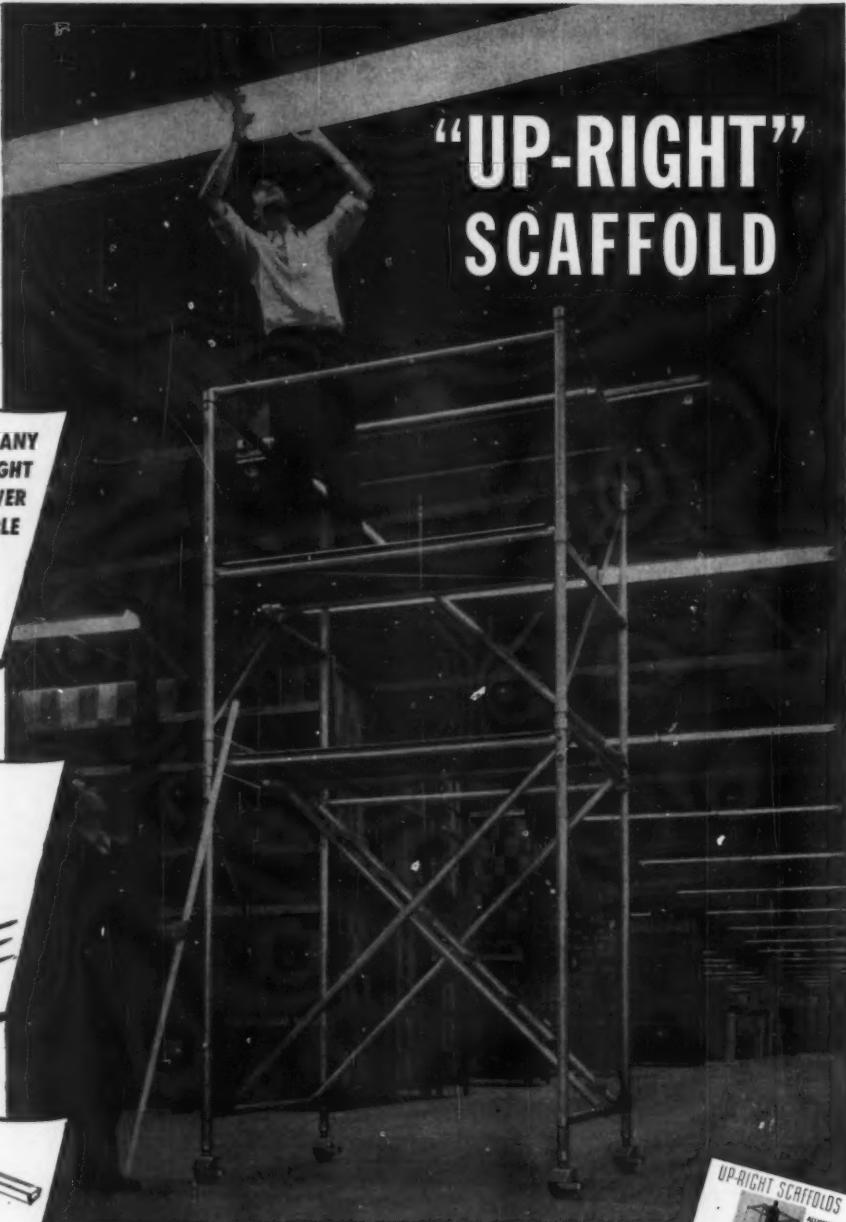


ANY
HEIGHT
TOWER
AVAILABLE

Rolls
with job



Scaffold
carries
fixtures



"UP-RIGHT" SCAFFOLD

Write for descriptive circular ➔

"UP-RIGHT" SCAFFOLDS

Dept. 159 • 1013 Pardee Street • Berkeley, California

Factories: Berkeley, Calif. and Teterboro, N. J. • Offices in all principal cities





Top: Clark Control Center for furnace control at Bohn Aluminum and Brass Corporation, Adrian, Michigan.

Inset: Separate access doors to vertical wireways simplify installation, inspection, service and maintenance.

SEPARATE VERTICAL WIREWAYS

Simplify installation and servicing of

CLARK CONTROL CENTERS

Roomy 6-inch wide vertical wireways for each section, independent of starter compartments and equipped with separate access doors, save time and money on installation of Clark Control Centers, and make them easier to service and maintain.

Ample wiring space is provided for all load and inter-wiring connections. Terminal boards may be located in vertical wireway adjacent to starters or at top or bottom of any section. Versatile bus-bar compartments permit the use of one to four sets of electrically isolated horizontal bus, permitting power to be fed from any or all of four different sources.

Clark Control Centers are the easiest to pre-plan and lay out because adding transformers and/or relays or changing type of construction (NEMA type A, B, or C) does not change space requirements.

Write for your copy of the 24 page illustrated book entitled "Control Centers by CLARK."

The **CLARK**
Engineered Electrical Control



CONTROLLER Company

1146 East 152nd Street • • • Cleveland 10, Ohio

Core and coil construction is carefully designed for minimum power loss; close control of noise and heating. Quality insulation throughout—protects against failure, assures longer life.



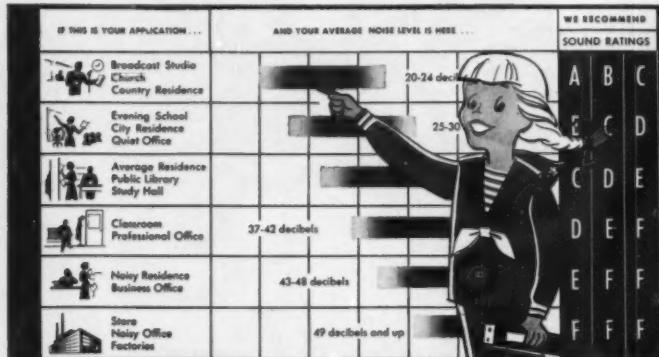
All components, like this G-E Pyranol[†] capacitor, are manufactured to our precise specifications.

[†]Reg. Trade mark of General Electric Co.

Every part of a G-E ballast is carefully designed, manufactured, tested and assembled to give you the best ballast value.

Flora* shows you

General Electric



1. SOUND RATING—Only G-E ballasts are sound-rated to assure you of meeting your sound level requirements. You can choose the proper G-E ballast whether it's for a quiet installation or for an application where noise is less important. G-E sound rating eliminates expensive noise complaints.



4. LAMP-MATCHED DESIGN—The ballast governs light output and life of the fluorescent lamp. G-E ballasts are lamp-matched to provide up to 50% longer lamp life and up to 30% more light output. Here you save two ways—lower lamp replacement costs and more light from your installation.

Whether you use, install, specify or make fluorescent fixtures, G-E ballasts mean savings to you!

The six reasons why you save, described by Flora above, grow out of these simple facts:

- G-E ballasts are designed to high engineering standards (1, 3, 4, 5 above).
- G-E ballasts are made under exacting quality control standards (2 above).
- G-E ballasts are backed by complete sales and engineering services (6 above).

Only G.E. offers you all these money saving features.

In every conceivable way, we make sure you get more when you use G-E ballasts. For example, G-E engineering standards

six ways . . .

ballasts help you save lighting dollars



2. UNIFORMLY HIGH QUALITY—Lighting specifiers have learned to depend upon the consistently high quality of G-E ballasts. Rigid material specifications and constant production line tests mean uniformly good ballasts; save lighting dollars on early replacement and maintenance costs.



5. PROVED PRODUCT LEADERSHIP—General Electric has the largest group of specially trained ballast design and development engineers in the industry. They're constantly improving G-E ballasts, assuring you of all benefits of top quality when you "specify" General Electric.

actually exceed the specifications established by the Certified Ballast Manufacturers where extra quality pays off to you. Another example: Ten quality control stations make dozens of physical and electrical checks during manufacture to assure that each ballast measures up to the high G-E standards.

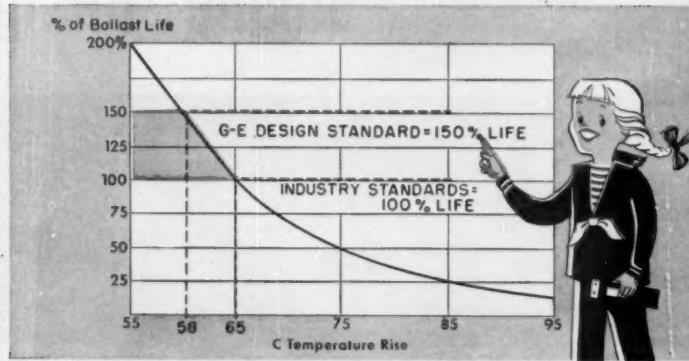
Next time, specify General Electric Ballasts. Dollar for dollar they're your best ballast value.

LOOK FOR THIS G-E BALLAST TAG

A G-E ballast tag on your fixture is proof that it's equipped with a top-quality ballast. It's the easy way to be certain. For further information on G-E ballasts, contact your nearest G-E Apparatus Sales Office or G-E Distributor. General Electric Company, Schenectady 5, New York.

401-7

*Miss Flora Ballast, G-E Ballast Mascot.



3. LONGER LIFE—G-E ballasts are designed to operate 10% cooler than U.L. and Certified Ballast Manufacturers' standards. Tests show that a 10% reduction in ballast temperature rise can mean up to 50% longer ballast life, giving you half again as much ballast life!



6. COMPLETE CUSTOMER SERVICES—General Electric's extensive sales, warehousing, and engineering organization is anxious to serve you. These unequalled facilities can provide services for you which no other ballast manufacturer offers. These extra services mean real saving to you.



Progress Is Our Most Important Product

GENERAL  **ELECTRIC**



DRY-TYPE TRANSFORMERS

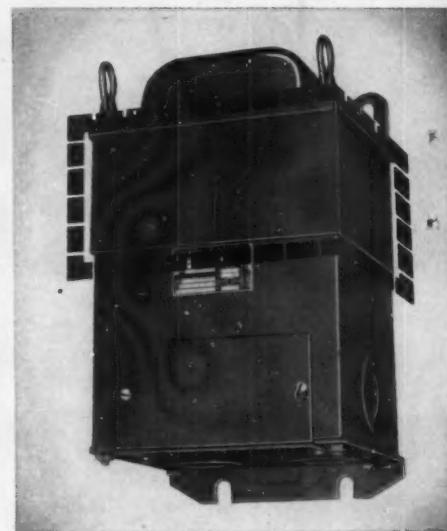
Standard lines cover wide range of unique design features; Sell at



Longer life . . .

TYPE M TRANSFORMERS perform longer because the entire core and coil assembly is thoroughly impregnated by an electronically controlled vacuum pressure process which

removes all moisture, decreases electrical losses, combats corrosive atmospheres. Varnish insulation penetrates the entire unit, and not merely the exposed surface.



Greater operating efficiency . . .

TYPE M TRANSFORMERS. Design feature exposes a large area of the core surface permitting more efficient cooling. Heat is dissipated by radiation as well as convection.



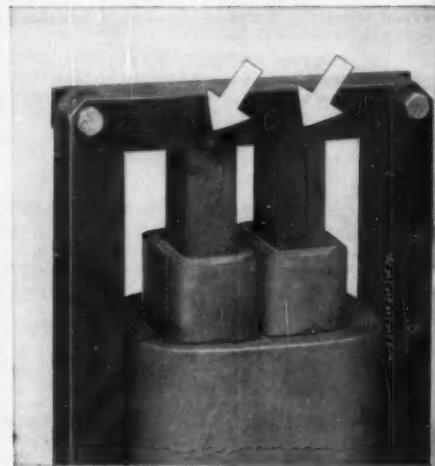
Precalibrated . . .

VOLTAGE STABILIZERS calibrated at the factory. Output voltage is stabilized within less than $\pm 1\%$, for all input voltage variations from 95 to 130 (190 to 260) volts. Adjustments of voltage level are held within $\pm 1\%$ of nominal, the majority within $\pm \frac{1}{2}\%$ of nominal for normal operating temperatures.



Speedier installation . . .

MERCURY LAMP TRANSFORMERS. Nameplate covers large wiring compartment. This functional positioning speeds installation and maintenance by putting complete easy-to-read wiring instructions and diagrams right where they are needed. Bolt on left holds plate to case, helps prevent its loss.



Economical operation . . .

SATURABLE REACTORS permit more precise control of load voltages because of a tongue-joint construction in core laminations. It reduces chances of damage to expensive control components; allows virtually complete balancing out of a-c flux to eliminate induction of a-c voltage in the d-c coil.

applications; Incorporate competitive prices

Using precise mass-production techniques, General Electric is producing a standard line of specialty and general-purpose Dry-type Transformers with unique exclusive design features that result in better performance. By meeting the demands of industry for a long period of years, G.E.'s standard line of transformers has grown to cover an extremely wide range of applications. Built to industry's highest standards, they are sold at competitive prices.

DESIGNED TO YOUR REQUIREMENTS

Today, General Electric has a separate department established for the sole purpose of developing and producing a standard line of Specialty and General-Purpose Transformers. It is staffed with experienced engineers who will accept the challenge of solving your special transformer problem. Usually it can be solved

with a standard unit. But, if an existing G-E model will not serve your particular need, G.E. will design one to your exact requirements. As an example, General Electric has on file more than 1000 different designs for saturable reactors, ranging in sizes from 3 to 450 kva, alone.

TESTED FOR ACCURACY

The same precise measures which control the quality of standard transformers are taken with the production of each specialty unit you specify.

In the manufacture of its Type M Transformers, for instance, General Electric submits each unit to a minimum of 18 different tests and inspections: a procedure which assures you of better performing standard-line transformers. For additional information, simply contact your nearest G-E Apparatus Sales Office, General Electric Co., Schenectady 5, New York.

Make "G.E." your source of supply for all these dry-type transformers.

For detailed information write for the free bulletins listed below.
Address: General Electric Co., Section 410-7, Schenectady 5, N. Y.

Amplistats GET-2424

Boost-buck Transformers GEC-1206

Distribution Transformers GEC-1207

High Reactance Transformers

Ignition Transformers GEC-1261A

Iron Core Reactors

Lighting Transformers GEC-976, GEC-1208

Liquid and Insulation Testers

Machine Tool Transformers GEC-1270

Magnetic Frequency Converters

Mercury Lamp Transformers LS-103

Mine Load Centers

Phase-changing Transformers GEC-1209

Photochemical Transformers

Power Packs

Power Transformers GEC-1207

Railroad Signal Transformers GEC-1251

Refrigerator Autotransformers

Saturable Reactors GEC-1296

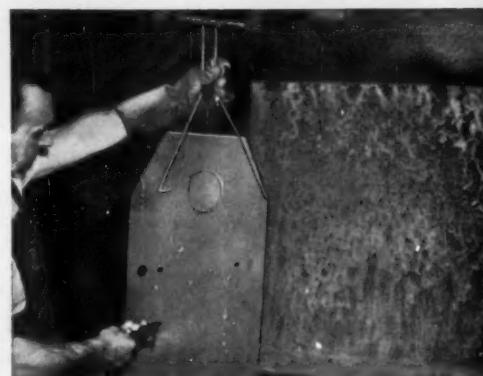
Telephone Line Insulating Transformers

Voltage Stabilizers GEA-5754



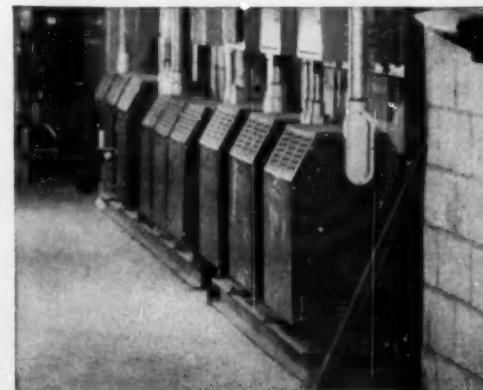
Easily accessible . . .

TYPE D TRANSFORMERS. Both front and top of case are easily removed to make connections easier and to simplify maintenance.



Longer wearing . . .

TYPE D TRANSFORMERS. Cases of heavy-gage steel are finished in weather-resisting enamel over rust-prohibiting primer.

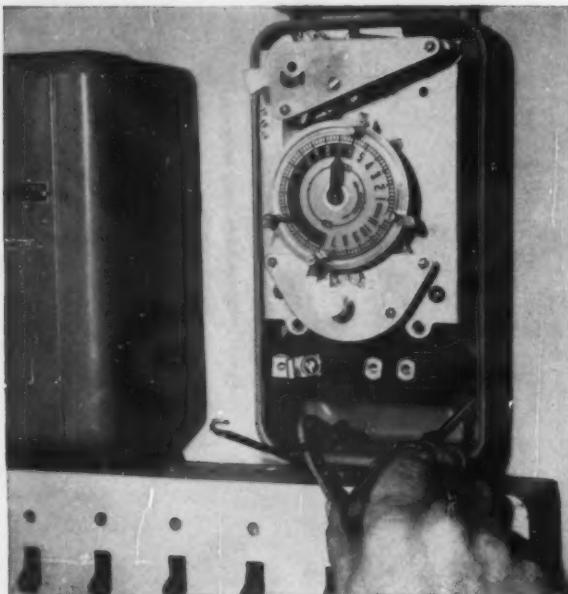


Convenient mounting . . .

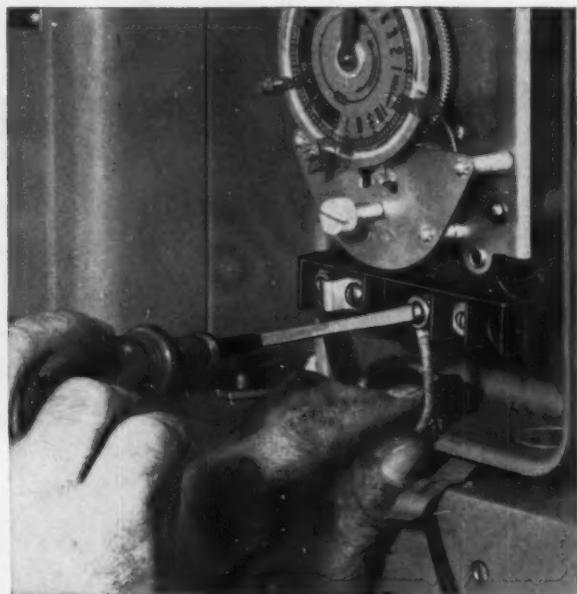
TYPE D TRANSFORMERS. Narrow depth of case design permits unobstructive mounting against wall, saving valuable working area.

Progress Is Our Most Important Product

GENERAL  **ELECTRIC**

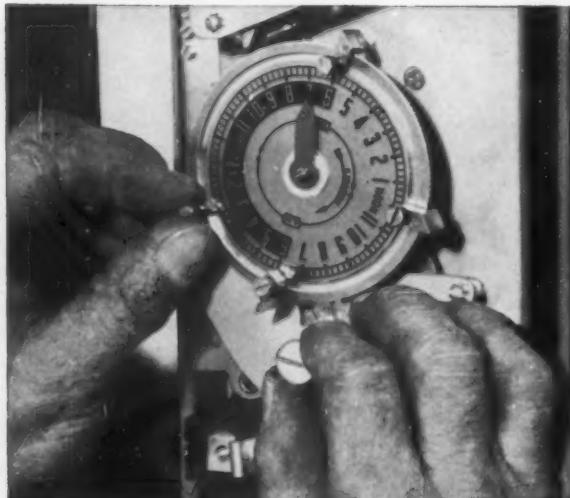


1 ATTACH SWITCH TO MOUNTING SURFACE: Hang by means of lug at top, secure with two screws through holes in case—takes only a few seconds; rugged, drawn-steel housing makes T-27 suitable for any outdoor-indoor installation.



2 WIRE: Connect to clearly marked, readily accessible terminal blocks at front of T-27—requires little time. A minimum of circuit connections, maximum hand room below terminals and five double knockouts facilitate quick wiring.

Reduce Installation Time With Dependable General Electric Time Switches



3 SET DIAL: Adjust to correct time, position trippers for desired on-off period—easy as setting a wrist watch. With omitting device, T-27 skips days; with astronomic dial, follows dusk-dawn schedule; performs 10 on-off operations daily.

3 Simple Steps Make Installation of General Electric's T-27 Time Switch Extremely Fast and Easy

ONCE INSTALLED and set, the T-27 will give years of reliable, dependable on-off control.

ACCURATE TIMEKEEPING is assured by a self-starting, self-regulating, permanently lubricated Telechron* motor, sealed to keep out dirt and dust.

RUGGED CONSTRUCTION insures little maintenance. All parts of T-27 switch mechanism subject to heavy duty are made of copper-nickel-plated steel, and switch blades are of beryllium copper for the best combination of mechanical and electrical characteristics.

FOR MORE INFORMATION on T-27, contact your nearest authorized G-E Time Switch distributor. Ask for G-E Time Switches at his store; and write for Bulletins GEA-5965 and GEC-535C to Section 603-168, General Electric Company, Schenectady 5, N. Y.

*Reg. Trade-mark of General Electric Co.

GENERAL  ELECTRIC

G-E Capacitors at Colson Corporation raise power factor, save \$3600 a year



Jack E. Davis, Plant Manager, discusses G-E capacitor installation in wood shop with Art Davis, plant superintendent.

G-E capacitors installed out of the way and near power line in the Truck Shop at Colson Corp., Elyria, Ohio.

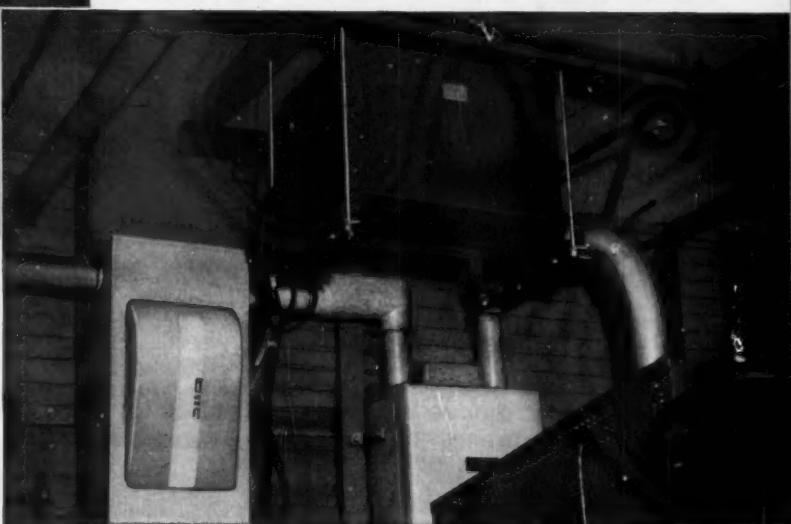
"Power factor has jumped from a low of 84% to over 95% and we're saving \$300 a month," reports Arthur Davis, Superintendent at the Colson Corp., Elyria, Ohio.

"Except for an occasional check of fuses, we have put them up and forgotten about them," Mr. Davis reports. "We were able to locate all of them on platforms keeping them out of the way and nearer to power lines."

With the assistance of the Elliott Electric Co., 450 kvar of capacitors at 230 volts were installed which released the strain put on transformers during peak production periods and eliminated the necessity of rewiring or the addition of expensive new equipment.

It will pay you to investigate the possibility of a capacitor installation in your plant. If your power factor is below 85% and if there is a power factor or kva-demand clause in your power bill, chances are, you too can make substantial savings in your power bill by installing capacitors. Besides reducing your power bills, capacitors can release extra system capacity and permit your distribution system to carry 20 to 30 percent more load.

For more information about G-E industrial capacitors, contact your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-5632 to Section 441-109, General Electric Company, Schenectady 5, N. Y.



Progress Is Our Most Important Product

GENERAL  **ELECTRIC**

COMPARE **LEV-O-LOCK** DEVICES FOR

QUALITY

For uninterrupted power flow, LEV-O-LOCK devices are unexcelled. They incorporate every up-to-date advantage in engineering design made available by Leviton's half-century experience as leader in the wiring device field. Leviton makes sure every part is made and quality-controlled within the plant. Most rigid tests and standards have to be met. Listed by UL and CSA.

COMPARE **LEV-O-LOCK** DEVICES FOR
PERFORMANCE

Outperforms all others on basis of actual laboratory tests. Sturdy phenolic stands up even in roughest applications. Receptacles feature double wiping contacts, made of heavy, wear-resistant phosphor bronze. Wiring is faster, simpler — extra large binding screws make it so! It's easy to change over to LEV-O-LOCK devices. They're interchangeable with other standard locking-types.

COMPARE **LEV-O-LOCK** DEVICES FOR
PRICE

Leviton buys huge quantities of the best in raw materials — then mass produces every component part of every product to precise Leviton standards . . . whether it's small screws or metal plates. The result? LEV-O-LOCK is a truly precise, superior product — at a trim price that defies competition!

Why pay more when the best costs less?

your best jobs are done with . . .

LEVITON

Send for literature:

LEVITON MANUFACTURING COMPANY • BROOKLYN 22, N. Y.
Chicago, Los Angeles • Leviton (Canada) Limited, Montreal
For your wire needs, contact our subsidiary
AMERICAN INSULATED WIRE CORPORATION

PUSH-TURN—AND IT'S LEV-O-LOCKED



Receptacle



Receptacle on Plate



Cap



Cord Connector

Available in 2, 3 and 4 wire Caps,
Connectors and receptacles in 10 and 20
AMP. ratings.



**The data you need
easy to find in this Uptraff**

ENGINEERING MANUAL

Designed for quick reference, this manual gives in easy-to-find form, dimensions, performance data and other essential information on Uptraff Power Transformers of all commercial ratings from 750 to 10,000 KVA. It describes liquid-filled, single and three-phase transformers up to the 67 KV Class. Standard and optional accessories are listed; terminal arrangements, vector relationships and schematic representations are shown.

Copies of this engineering manual will be useful in many ways in executive, engineering and operating departments.

**R. E. Uptraff Manufacturing Co.
Scottdale, Pennsylvania**

Send

for free copy of this useful Uptraff Power Transformer ENGINEERING MANUAL. Write on company letterhead or use the coupon below.

R. E. UPTEGRAFF MANUFACTURING CO. (ECM)
Scottdale, Pennsylvania

Gentlemen: Please send a free copy of your ENGINEERING MANUAL Bulletin 133 to:

Name _____ Title _____
Company _____
Address _____

Here are the facts about Triangle's *Hot-*

Triangle Hot-Dip Galvanized Rigid Steel Conduit is produced from choice sections of the highest grade ingots. This insures a perfect base for proper bonding of the zinc. Every length is thoroughly scoured and pickled in acid, leaving the pipe perfectly clean before the application of the protective zinc coating.

When perfectly clean, the conduit is immersed in a bath of molten zinc, coating the interior as well as the exterior with a solid, unbroken layer of virgin zinc (99.9% pure). The hot-dip process results in an alloying action that bonds the heavy, pure zinc coating to the pipe. As added protection against corrosion, the conduit is submerged in special formula lacquer, then baked, giving the conduit a smooth, even finish.

Conforms to Federal Spec.
WWC-581b (Galvanized)

Combination of galvanizing and lacquer makes the inside smooth, uniform and well protected.

EVERY LENGTH OF CONDUIT
IS IMMERSED IN A BATH OF
MOLTEN ZINC — 99.9% PURE



Every square inch of the conduit — inside and outside — is thoroughly and uniformly coated with pure zinc. Remember, because of condensation, the inside of conduit is just as subject to corrosion as the outside. That's why it's important to specify Triangle Conduit — protected inside and outside.

**HOT-DIP GALVANIZING IS
UNIFORM
*NOT TOO THIN-***

Coatings that are too thin in even one spot, are likely to develop tiny pin-point holes through which corrosion can creep. There is no possibility of thin spots in zinc applied by the Triangle hot-dip galvanizing method. The thickness of the zinc coating is uniform — exactly the same from one end to the other. Hot-dip galvanized coating is two or three times as thick as other coatings.

Dip Galvanized Conduit.

TRIANGLE

NOT TOO THICK-

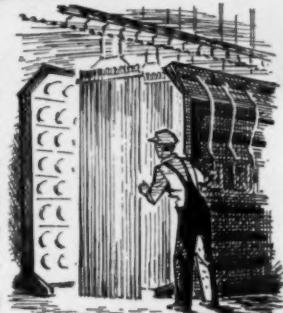
If the coating on conduit is too thick, it is subject to cracking and flaking when being bent. Careful controls keep the coating of Triangle Conduit at just the right thickness — always.

**Never too thick —
never too thin.**



**AND
AN EXTRA BONUS!**

A clear lacquer is applied and baked on the conduit. Not only does Triangle apply the best protective coating (molten zinc) but Triangle also bakes on an additional transparent lacquer of special formula. The application of this baked-on coating insures a permanently smooth interior (for easy pulling) and also provides additional protection against rust or corrosion. It also protects the conduit during shipment.



TRIANGLE CONDUIT is Hot-Dip Galvanized— and **TRIANGLE'S** Hot-Dip Galvanizing has never been surpassed!



TRIANGLE CONDUIT & CABLE CO., INC. New Brunswick, N. J.

Manufacturers of Arteries for Electricity, Liquids and Gases

WIRE • CABLE • CONDUIT • PLASTIC PIPE • BRASS AND COPPER TUBE

Plants—New Brunswick, N. J.: Wire and Cable Plant, Rod Mill, Brass and Copper Tube Mill, Plastic Pipe Plant. Moundsville, W. Va.: Conduit Plant.

"It MUST Be Right!"

What they say...

about
SORGEL
 air-cooled dry-type
transformers



7 1/2 Kva single phase



50 Kva wall mounting transformer,
 with front panel removed, showing roomy connection
 compartment and solderless terminals.

"The unique arrangement for entering conduits and roomy connection compartment saved us money."

"We needed a quiet transformer, so we selected SORGEL."

"We like the way the 50 Kva is equipped with wall brackets. With another make we had to make special brackets at extra expense."

"When we turned on the current we were amazed at how quiet it was."

"The solderless terminals save money."

"Upon checking the reason for the circuit breaker going out frequently, we found that the transformer was carrying overloads up to 25% at times, and showed no signs of over-heating."

"It gets the job done where others do not."

"With the 'Underwriters' label on SORGEL transformers, there is no question from inspectors."

"We have enjoyed nice sales on this transformer — for one reason — **QUALITY.**"

— and many more praises and compliments from appreciative customers. You, too, will be well repaid by investigating the reasons for the ever-increasing preference for SORGEL transformers.

Complete Line

1/4 Kva to 1500 Kva single phase.

1 Kva to 3000 Kva 3-phase, 2-phase, and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special lower voltage.

Stock carried by jobbers in the following cities:

Milwaukee, Wis.	Roxbury, Mass.
Chicago, Ill.	Cleveland, Ohio
Rock Island, Ill.	Louisville, Ky.
Rockford, Ill.	Omaha, Neb.
Richmond, Ind.	Davenport, Iowa
New York, N.Y.	Cedar Rapids, Iowa
Buffalo, N.Y.	Beaumont, Tex.
Los Angeles, Calif.	

Also Special Transformers and Saturable Reactors

Consult the classified section
 of your phone directory,
 or write to the factory

SORGEL ELECTRIC CO. 836 West National Ave.
 Milwaukee 4, Wisconsin

40 years experience in the development, manufacturing
 and application of transformers



SQUARE D Reduced Voltage STARTERS



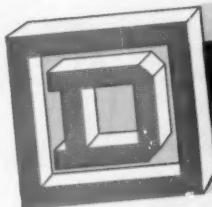
One of these **4** types will meet your requirements . . . best

- Is minimum motor current inrush your primary consideration?
- Is it reduced starting torque? • Or maximum smoothness in acceleration?
- Is cost an important factor?

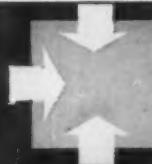
With these four types Square D can meet any reduced voltage starter requirement—exactly.

Write for Reduced Voltage Starter Bulletins. They give complete details.
Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR **SQUARE D PRODUCTS**

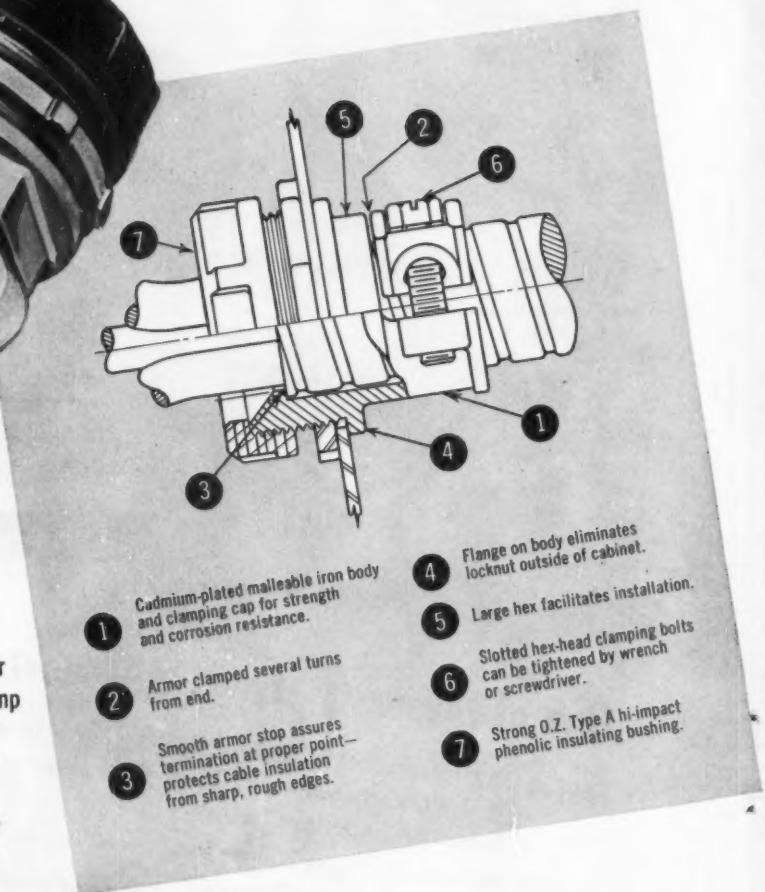


SQUARE D COMPANY



from every angle-

O.Z. is the clamp



Here is a clamp designed specifically to meet the requirements of interlocked armor cable applications. The O.Z. Type "PK" Clamp provides exceptional speed and ease of installation, whether your cable enters the cabinet from the top, bottom or side. It is designed with ample thread length for use with all standard conduit fittings and terminators from 1" to 5" and is available for interlocked armor cable ranging in size from .99" to 4.38" O.D.

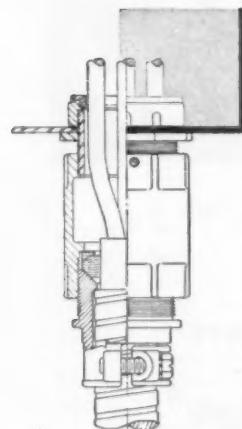
Call your local O.Z. Distributor.



for ARMORED CABLE

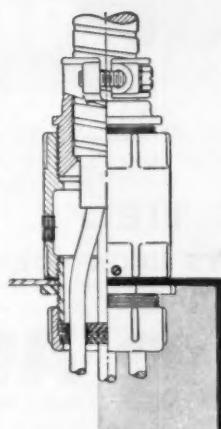
combines with standard O.Z. fittings for any terminating or splicing job involving INTERLOCKED ARMOR CABLE.

Seals cable ends to protect insulation against moisture and other contaminants—can also be used with threaded hubs and bosses to provide watertight cable entrances.



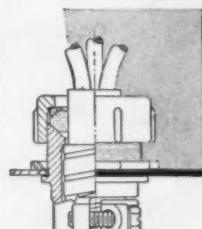
TYPE "PKC"

Terminator for interlocked armor cable entering bottom of cabinet.

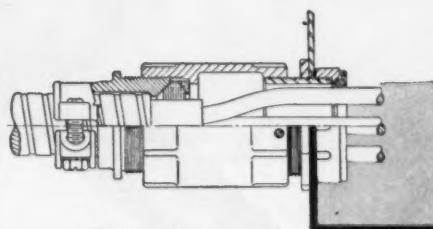


TYPE "PKT"

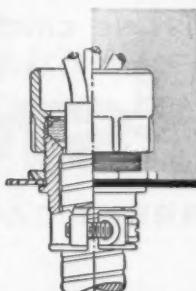
Terminator for interlocked armor cable entering top of cabinet.



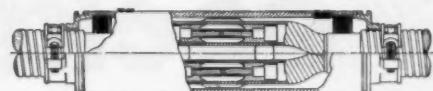
TYPE "PKG"
Sealing bushing for interlocked armor cable entering cabinet.



TYPE "PKH"
Terminator for interlocked armor cable entering side of cabinet.



TYPE "PKF"
Compound bushing for interlocked armor cable entering bottom of cabinet.



TYPE "PKS-J"

Splicing chamber for interlocked armor cable.

O.Z.

ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

CAST IRON BOXES
CABLE TERMINATORS
POWER CONNECTORS
SOLDERLESS CONNECTORS
GROUNDING DEVICES
CONDUIT FITTINGS



ARE YOUR HANDS TIED...
BECAUSE EXISTING CIRCUITS LACK ADEQUATE
CAPACITY TO CARRY THE LOAD

ROCKBESTOS A.V.C. (N.E.C. TYPE AVA)

CAN INCREASE CURRENT CAPACITY 30 TO 50%

All you need do to get added capacity without changing present conduit is to rewire present circuits with Rockbestos A.V.C. . . . the wire and cable that size for size carries more current than other

types of insulated wire.

Phone or write the nearest Rockbestos branch office and one of our wire specialists will analyze your particular requirements.



ROCKBESTOS PRODUCTS CORP.
NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO
PITTSBURGH • ST. LOUIS • LOS ANGELES • NEW ORLEANS
OAKLAND, CALIFORNIA • SEATTLE



STOCKED COAST TO COAST
Standard Rockbestos A.V.C. (N.E.C. types AVA, AVB, etc.) are available from stock for immediate shipment. Call or write nearest branch office.

*the answer to
increased residential
electric service demands*

NEW FA SPLIT-BUS
circuit breaker type
**SERVICE
EQUIPMENT**

Install these new **⑦** "Enclosed Panel Base Assembly" type units in all residential buildings, both new and those being modernized.

Approved by the Underwriters' Laboratories, Inc., for label service, these units effectively solve the problem of expanding residential power demands.

They provide capacity for electric ranges, water heaters, dryers, air conditioning, etc., and sub-feeder circuit to an additional center of distribution.

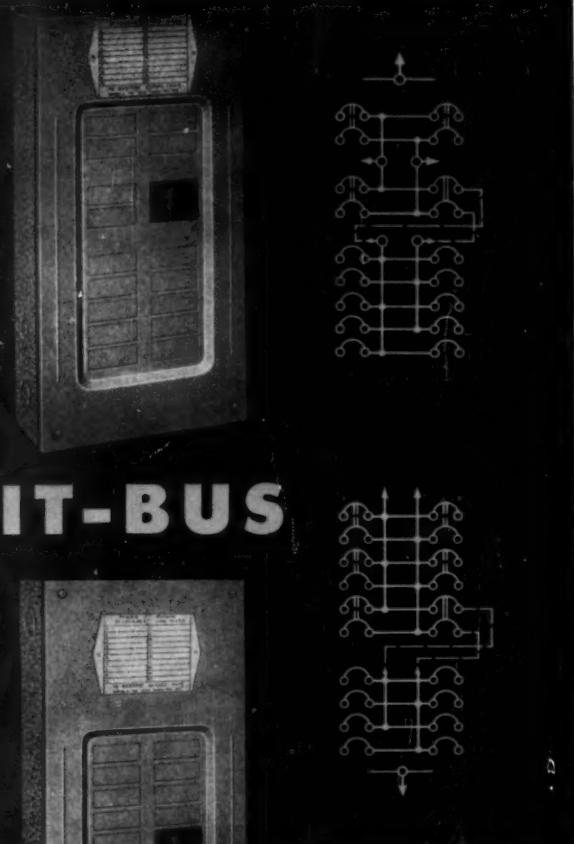
The new units have 100 or 200 amp. feeder capacity for single phase, solid neutral service. Each is furnished with one service connection having a double pole 50 amp. circuit breaker with wire connection to the lighting and appliance branch circuit section.

Another big feature is that the units, together with a stock of individually-packaged **⑦** T-M and QP Thermal-Magnetic Circuit Breakers are available from **⑦** distributor's stocks for quick and easy assembly on the job. So be sure to include these units in all future residential type of construction.

For further information, contact your nearest **⑦** distributor or **⑦** representative listed in Sweet's Architectural and Builder file.

Frank Adam Electric Co.

BOX 357, MAIN P. O. • ST. LOUIS, MO.



*Illustrated
are both
the 100 and
200 amp. units*

SPECIFIC DATA ON SPLIT-BUS SERVICE EQUIPMENT

Catalog No.	Amp. main capacity 3-wire single phase	Max. No. Branches		Size
		DP	SP	
⑦SE4DPL100-10SPL50	100	3	10	9" x 18" x 3½"
⑦SE60PL200-8SPL50..	200	5	8	9" x 24" x 3½"

All circuit breakers are thermal-magnetic, quick make and quick break. Capacities, 10 to 30 amps. are **⑦** T-M and 40 and 50 amps. are **⑦** QP. Adjoining single pole branches can be fitted with handle extensions for double pole individual trip operation.

*Makers of: busduct • panelboards •
switchboards • service equipment •
safety switches • load centers • Quikheter*



Rome Aluminum Triplex

Triplex Self-Supporting Secondary and Service Drop Cable—Regularly supplied with stranded or solid all-aluminum power conductors, insulated with RoPrene (Neoprene) and incorporating ACSR or other suitable bare neutral messenger. All-aluminum, copper or copperweld messengers are also available. RoLene (polyethylene) insulation can be supplied in place of RoPrene.



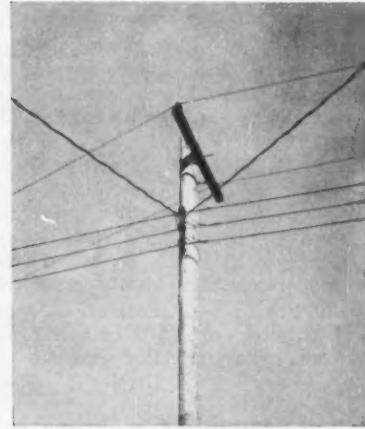
Rome Triplex Service Drop Cable provides neat, clean looking installation in new homes area.



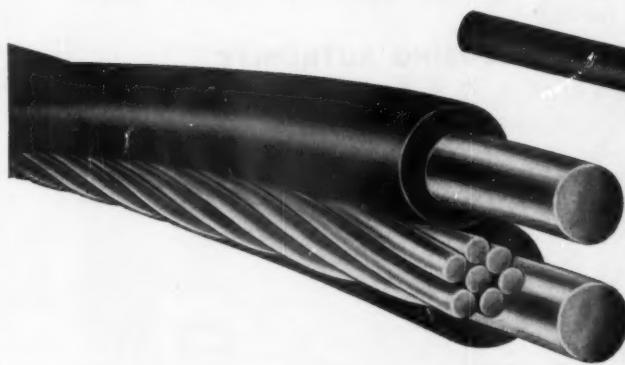
Triplex is ideal for replacements on older houses too, particularly where eaves and roofs pose space problem.



Rome Triplex is less subject to damage by storm and falling tree limbs . . . will remain in operation SAFELY even when down.



Installation at pole and house is easy and quick, cutting costly manhours and permitting less expensive hardware.



Rome Weatherproof Wire

Regularly supplied with solid or stranded all-aluminum or ACSR conductors, covered with RoLene or RoPrene. Conventional URC triple braid covering can also be supplied.

OFFERS YOU A HOST OF COST ADVANTAGES

Many applications of Rome Aluminum Triplex secondary and service drop cable show outstanding cost advantages over conventional bare or weatherproof open wire construction.

For one thing, by proper mechanical design it may eliminate one-third to one-half the number of poles normally required. This adds up to a substantial saving. Further, it is also possible to utilize mid-span connections for service drops.

Rome Aluminum Triplex is particularly desirable for new residential developments. It is neat in appearance while mechanical design and light weight minimize sag tendencies. This cable construction, with its strong messenger, also affords greater protection against wind and ice loading damage.

Fewer accessories are needed

for secondary and service drop connections than for open wire construction. Maintenance is less costly; conductors are easily accessible.

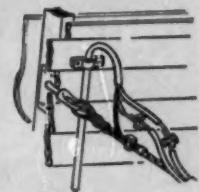
Longer service life is assured because of mechanical design. RoPrene (Neoprene) and RoLene (polyethylene) insulation have exceptional resistance to weather and all climatic conditions. There are no braids to rot or festoon. Replacement is minimized.

So whether it's secondary or service drop cable or weatherproof wire for distribution, Rome Aluminum offers you a host of advantages. May we send you samples?

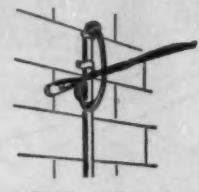
Typical Connections



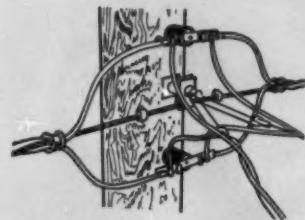
Service connection



Built-in attachment for dead-ending.



Dead end (house)



Service tap (from secondary cable)

It Costs Less to Buy the Best

Rome ALUMINUM

ROME CABLE CORPORATION, ROME, N.Y., AND TORRANCE, CALIF.

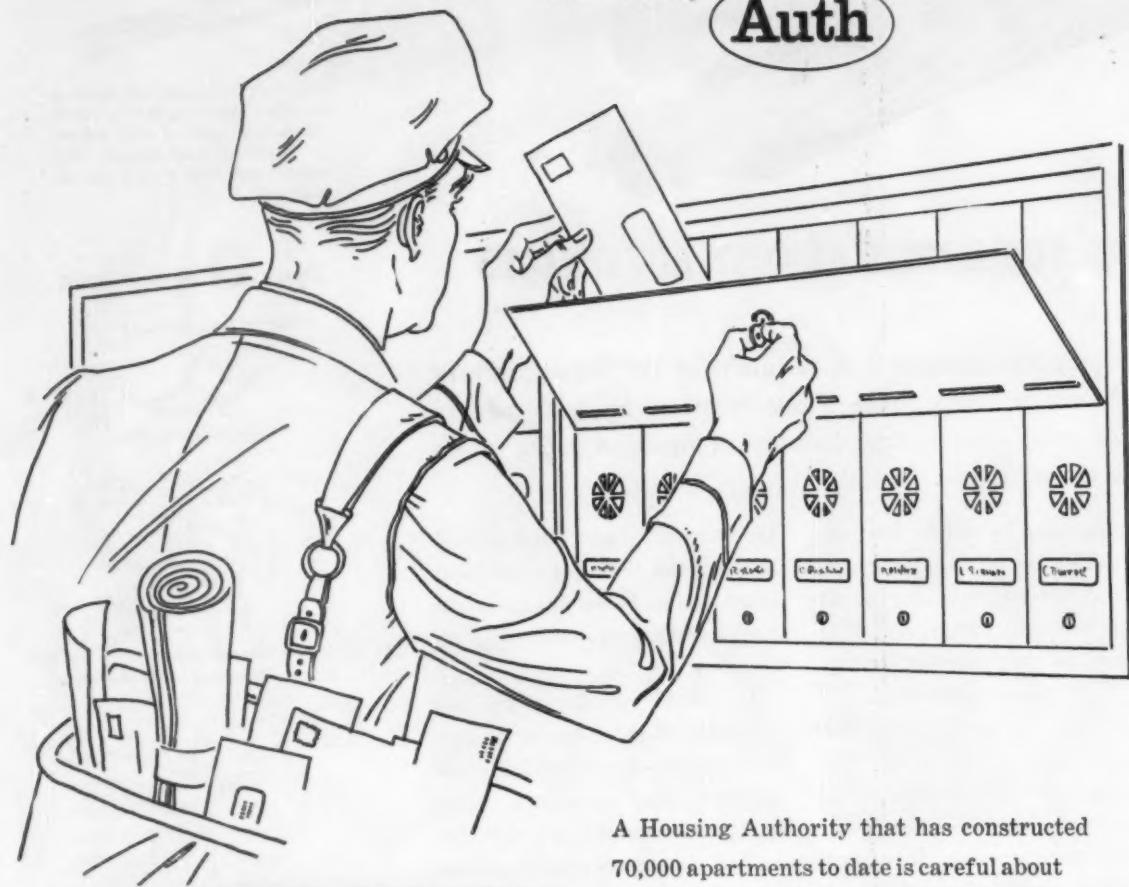
... and for the

NEW YORK CITY HOUSING AUTHORITY

over 97% of all the U. S. Approved

Mail Boxes and Non-Electric Door Chimes
were made by

Auth

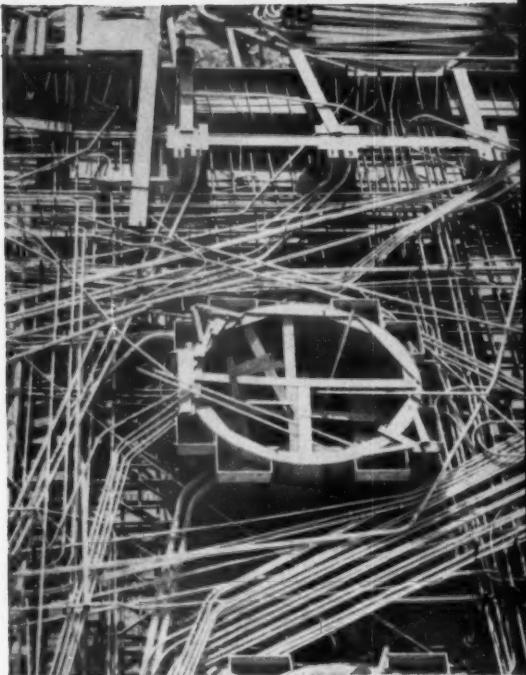


A Housing Authority that has constructed 70,000 apartments to date is careful about the quality of the equipment it specifies and approves. That is why we take pride in having supplied over 68,000 of this total with Auth Mail Boxes. Whenever door chime signals were specified for these apartments, too, Auth Non-Electric Door Chimes were selected. For information on mail boxes and door chimes for apartments write to *Auth Electric Company, Inc., Long Island City 1, New York.*

SIGNALING, TIME AND COMMUNICATION SYSTEMS FOR
HOSPITALS, SCHOOLS, HOUSING, INDUSTRY AND SHIPS

Auth

No more on-the-job thread rusting worries



Here's the development which has meant a revolutionary step forward to contractors and plant engineers—Pittsburgh Standard's exclusive new process of galvanizing threads on hot-dip galvanized conduit. Threads stay bright, clean, rust-free!

With no rusting in storage or on the job, and no more expensive thread chasing, hours and dollars are saved. No wonder the men who use hot-dip galvanized conduit are switching to Pittsburgh Standard—here's a bonus from our extraordinary new *Morrisville plant which dramatically shows why Pittsburgh Standard is the "Standard of the Trade."

Why not try it, and see for yourself?

Famous "Standard of the Trade" Products

RIGID STEEL CONDUIT

All Finishes

ELECTRICAL METALLIC TUBING

ELBOWS • COUPLINGS • FITTINGS

*Galvanized threads on all sizes from the Morrisville plant, and on sizes 2-in. and larger from the Etna plant.

with EXCLUSIVE
PITTSBURGH STANDARD
**GALVANIZED
THREADS
ON HOT-DIP
GALVANIZED CONDUIT**



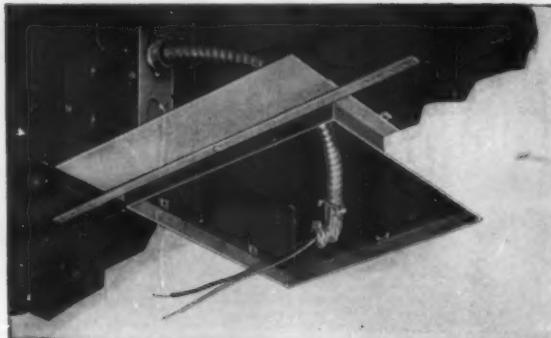
PLANTS AT MORRISVILLE & ETNA, PA.

WHOLESALEERS IN PRINCIPAL CITIES

ART METAL

makes your wiring

EASIER *and* FASTER



The Binary Plaster Frame of Art Metal units has complete installation equipment including attached junction box, wire, Greenfield and two mounting rails.

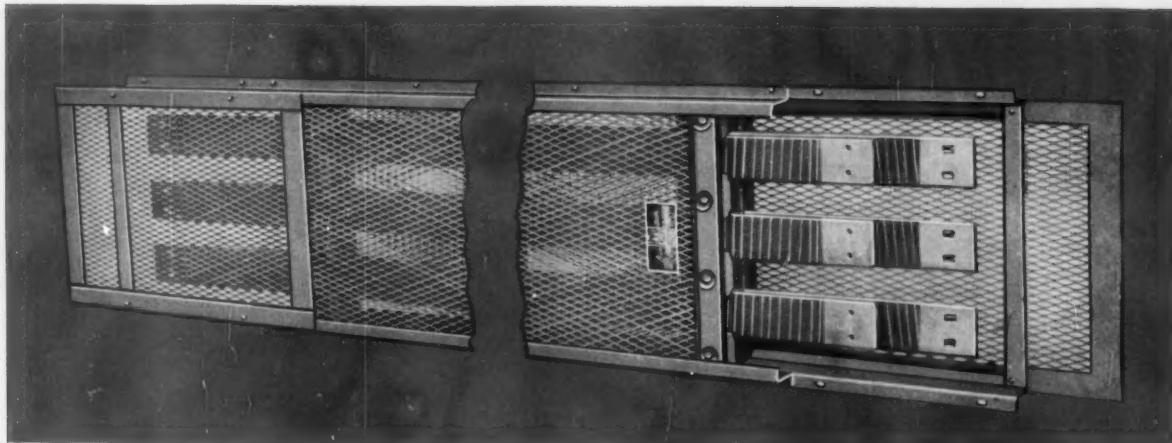


Complete specifications on Art Metal pre-wired plaster frame and lens boxes are found in Bulletin 254. We suggest you write for this bulletin . . . it'll show you how to save installation time and money on your next job!

Art Metal recessed lens box housings are easily installed as the job nears completion. Vertical slotted mounting holes provide adjustment for ceiling thickness from $\frac{1}{2}$ " to 2".

THE **ART METAL** COMPANY

CLEVELAND 3, OHIO



EXCLUSIVE SCARF-LAP CONSTRUCTION PROVIDES EXTRA-HIGH RIGIDITY AND STRENGTH. Duct sections come in tailored lengths, simply overlap and bolt together. Bulky, complicated joint fittings are eliminated. Elbows, tees and cross sections allow flexible installation anywhere. Exclusive paired-phasing arrangement assures lowest possible current carrying cost per ampere per foot.

BULLDOG LO-X BUS DUCT WITH LIGHTWEIGHT

Aluminum Bus Bars

costs less to buy—
less to install



EASIER TO HANDLE! LESS DEAD WEIGHT ON TRUSSES AND SUPPORTING MEMBERS!

You benefit two ways when you install BullDog Lo-X Bus Duct with lightweight aluminum bus bars: (1) Installation is easier. (2) You give customers a more flexible, more efficient feeder system.

The weight saved by using aluminum cuts handling and installation time. Lower first cost increases the saleability of BullDog aluminum bus duct. What's more, the lighter weight of the aluminum bus bars

eases the strain on building superstructures and other supporting members.

Dependable BullDog Lo-X Bus Duct is both efficient and flexible—can be easily relocated to fit any plant rearrangement. Let your BullDog Field Engineer or Qualified Distributor tell you about the many advanced BullDog products. Or, write: BullDog Electric Products Company, Detroit 32, Michigan. ©BERCO

IF IT'S NEW
... IF IT'S DIFFERENT
... IF IT'S BETTER . . . IT'S



BULLDOG

ELECTRIC PRODUCTS COMPANY
A Division of I-T-E Circuit Breaker Company

Export Division: 13 East 40th Street, New York 16, New York. In Canada: BullDog Electric Products Company (Canada), Ltd., 80 Clayton Road, Toronto 15, Ontario.



How the **VELOCITY-POWER** DRIVER helps you get more contracts—maintain profit levels

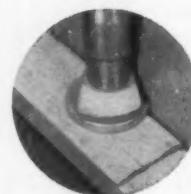
Designed for speed, ease of handling, and maximum safety, the Velocity-Power Driver gives you a real competitive advantage, without sacrificing profit. The unit is equipped for any stud-driving task. Interchangeable barrels let you drive either $\frac{1}{4}$ or $\frac{5}{8}$ -inch studs from the same firing unit. You have a wide selection of studs—solid head, internal or external threaded types. And because the cartridge and stud are integral, there's no time wasted matching and fitting.

Special care was taken to provide utmost safety. Unique barrel design avoids ricochet, flash, recoil. A spring-loaded safety arm that must be rotated and held before firing prevents accidental discharge. Permanently attached spall-shield adds to the safety factor of the unit. All cartridges are center-fire types, completely assembled, and color-tipped to assure the right load for the job.

Write today for complete details . . . see how the Velocity-Power Driver can help do more work, faster, and still maintain your profit level on every job.

VELOCITY POWER TOOL COMPANY

201 North Braddock Avenue, Pittsburgh 8, Pa.



There's no slow-down on those narrow, recessed spaces or close-to-the-wall jobs. The spall-shield is readily retractable, or a portion of the shield can be rotated out of the way. Quadrant marks on the shield provide accurate installation of the stud.

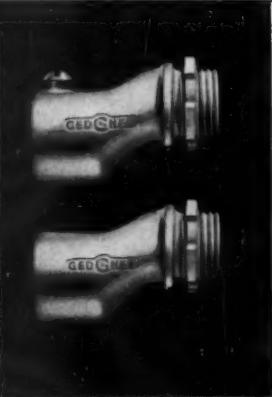


The Velocity-Power Driver, with separate spall-shield, featuring all the advantages of the above unit, is also available. This serviceable Driver is especially useful when a great deal of work in deeply recessed areas is required.

FOR ROCK-BOTTOM INSTALLATION COSTS SPECIFY GEDNEY!

GEDNEY FITTINGS are machined and threaded with utmost accuracy... smooth-finished, with no metal particles or burrs... made of malleable iron to eliminate breakage... individually inspected to

ensure absolutely top quality. That's why they're quickest, least costly to install... Specify Gedney Fittings and you'll find, like thousands of others, that this is the most profitable line available today!

	<p>Gedney 90° Pull-In Ells and Adapters with Neoprene gasketed cover and self-retaining screws. These fittings may be used to convert a straight box connector into a 90° connector, or as a 90° box connector for rigid standard pipe coupling. Ells have female threads at both ends. Adapters have male threads at one end and female at the other. Made of malleable iron and cadmium plated. Sizes $\frac{1}{2}$" to 2".</p>		<p>Gedney Offset Connectors—eliminate the necessity for offsetting conduit at knockout entrances of standard boxes. Threaded for rigid, set screw for EMT. Made of malleable iron, cadmium plated, in sizes from $\frac{1}{2}$" to 2".</p>
	<p>Gedney Corner Pull-In Elbows are outstanding for space saving, machine wiring, easy wire pulling. Malleable iron, cadmium plated. Made in $\frac{1}{8}$", $\frac{3}{8}$", $\frac{1}{2}$", $1\frac{1}{4}$", $1\frac{1}{2}$" and 2" sizes.</p>		<p>Gedney Offset Coupling—female both ends—for use as an offset between boxes. Can also be used with conduit nipple (Gedney 7-50 series) to give more room in box than otherwise possible. Gedney Offset Nipple, male both ends. Both of these fittings are made of malleable iron, cadmium plated. Available in sizes from $\frac{1}{2}$" to 2".</p>



GEDNEY
ELECTRIC COMPANY



RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

GEDNEY FITTINGS FIT

new lighting solutions from ELECTRO SILV-A-KING

PROBLEM

How to create larger light source areas more economically . . . and how to utilize the same basic fixture throughout the installation.

MODULAR SQUARES

BAYLITE

... in modular squares from 2' x 2' to 5' x 5' for surface or recessed mounting, slimline or fluorescent.

Lighting patterns take on new flexibility with versatile BAYLITES. They can be used individually, in continuous runs, or grouped to create a "louver-all" appearance for large light source areas with a minimum number of fixtures.

BAYLITE units can be recessed or surface mounted . . . and the extremely wide range of possible light intensities allow their use throughout an entire installation so as to achieve a pleasing, uniform effect.



TM TROFFER SERIES

PROBLEM

How to improve the aesthetic qualities of Troffer lighting with a reduction in installation and servicing costs.

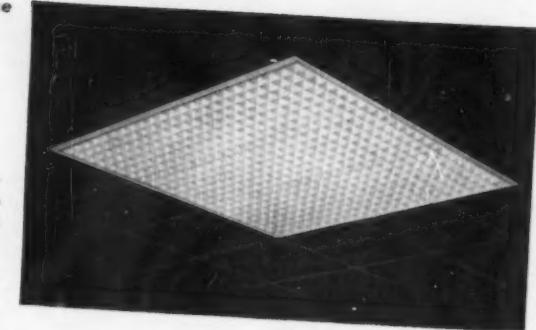
Exclusive

magic frame

TROFFERS

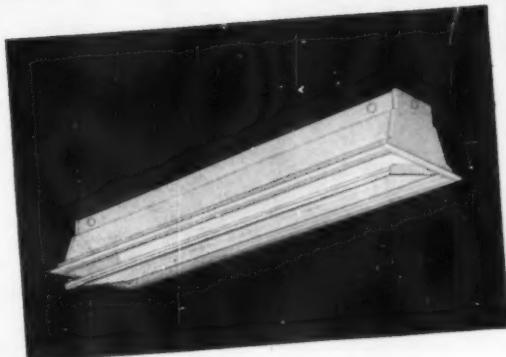
... eliminate all exposed, unsightly door screws and latches. Exclusive simplified installation provides "Speedy Latches" in wireway channel for efficient and simple hanging. All electrical components are contained on a removable chained cover.

"MAGIC FRAME" Troffers have no unsightly protuberances to disturb the trim lines of the fixture. Doors lock by gravity, hinge on two concealed pivots for quick maintenance. Completely removable by merely lifting and shifting. For installation, maintenance or removal of the door, there are no screws to loosen, remove or lose . . . doors are interchangeable into any like



ELECTRO SILV-A-KING BAYLITES are available in several models or to your specifications.

- 2' x 2', 2' x 4', 4' x 4', 5' x 5'.
- Four, Six, Eight or Ten Lamps • Metal sides or skirts
- Gimbal Ring spots available for PAR-38 lamp
- 35° x 35° shielding—with standard metal louver (Plastic available)
- Rapid Start • Standard Fluorescent • Slimline



Magic Frame fixture.

"Magic Frame" Troffers are available with all types of flat glass and plastic diffusers such as: ALBA-LITE, FOTA-LITE, CRYSTAL-LITE, TWINLENS, P4 DIAMOND PATTERN PLEXIGLAS. 2-ft., 4-ft., 5-ft., 8-ft., lengths. Rapid Start • Standard Fluorescent • Slimline.

Write for the name of the ELECTRO SILV-A-KING district manager near you . . . and new Specification Data Catalog.

ELECTRO SILV-A-KING CORPORATION

1535 S. Paulina Street, Chicago 8, Ill. • Spruce and Water Streets, Reading, Pa.

KUHLMAN

POWER CENTER TRANSFORMERS

in one of America's largest ultra-modern automotive plants



Kuhlman unit substation transformers, such as shown in the above power center, are designed to meet today's industrial expansion and modernization. In this installation six 1500 KVA Kuhlman dry type core and coil units are spotted close to the load areas in three compact double-ended power centers. Each power center contains two identical core and coil units, one serving as a right hand unit and the other, turned 180°, serving as a left hand unit.

Kuhlman Electric Company, employing the most advanced engineering and construction methods, can supply power center core and coil units or the complete transformer sections with enclosure. Forced air cooling may be added to increase the KVA capacity for either peak load conditions or plant expansion.

Be sure to specify Kuhlman power centers when planning your plant's expansion or modernization program.

KUHLMAN

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN, CRYSTAL SPRINGS, MISSISSIPPI, SALINAS, CALIFORNIA



big, new recess catalog no. 50—now ready for YOU....

Your source of inspiration for unlimited pattern planning!
Keep the great GUTH TROFFER LINE at your fingertips:

1 x 4's—2 x 4's—4 x 4's
1 x 2's—2 x 2's...all recessed from top to bottom.

Recessed incandescents from 60 watts to 1500 watts,
and GrateLite* Ceilings, too...they're all in this
brand-new big catalog.

write on your letterhead for your copy now!

*TM Reg. U. S. & Can. Pats. Pend.

TRUSTED

THE EDWIN F. GUTH COMPANY

Guth

WHAT'S NEW IN MOTOR CONTROL? ★ ★ ★ GET IT FIRST IN CUTLER-HAMMER

Now industry's three-phase motors
can have full three-phase protection
with standard in-stock
motor control!



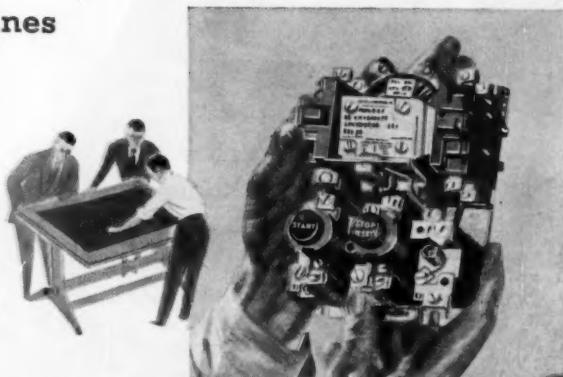
For designers of machines
and special control panels

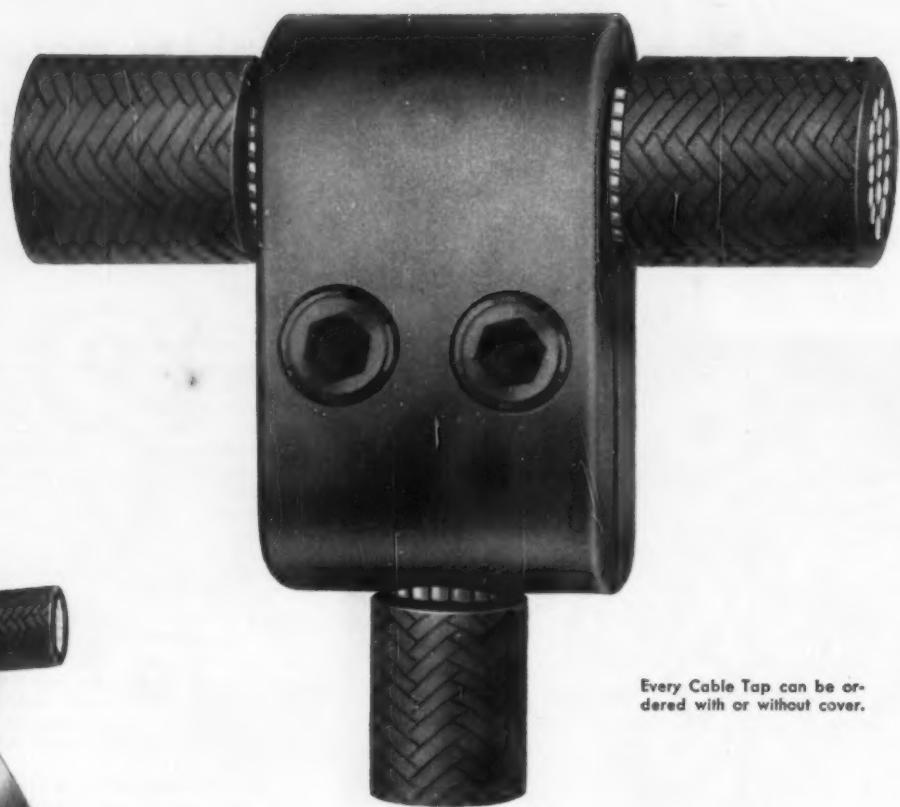
The unit panel construction of Cutler-Hammer ★ ★ ★ Motor Control makes it easy to incorporate starters with three overload relays. Starters mount in place with only three screws, require no more space than starters with only two overload relays. NEMA Sizes O, 1 and 2 starters and all parts thereof are now available as components. Also a complete companion line of control relays with quickly interchangeable NC-NO contacts. Be sure you have the latest design data on this advanced equipment. Write or wire today.

Many motor users have proved *two* overload relays are no longer adequate protection for three-phase motors. In fact, motor burn-outs have become so widespread that Section 4327 of the National Electrical Code was recently amended. The code now permits authorities to *require* three overload relays in three-phase motor control... and this provision is already being enforced in some areas. Many safety experts and power engineers say the time is not far off when three-phase motor control with less than three overload relays will be unacceptable.

The use of three overload relays is not new. Many industrials plagued by recurring motor burn-outs and the resulting intolerable operating interruptions have changed to three-relay control. But such changeovers have been slow to effect and costly as no standard control was available with three overload relays. Special constructions and enclosures have always been required.

The BIG news today is that this is no longer true. The new Cutler-Hammer ★ ★ ★ Motor Control offers *three* overload relays in all standard starter constructions and enclosures. You pay only for the third relay, nothing additional for special engineering or manufacture. No extras. No delays. It is *in stock* at your nearby Cutler-Hammer Authorized Distributor. Order it today and use it tomorrow. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wis.



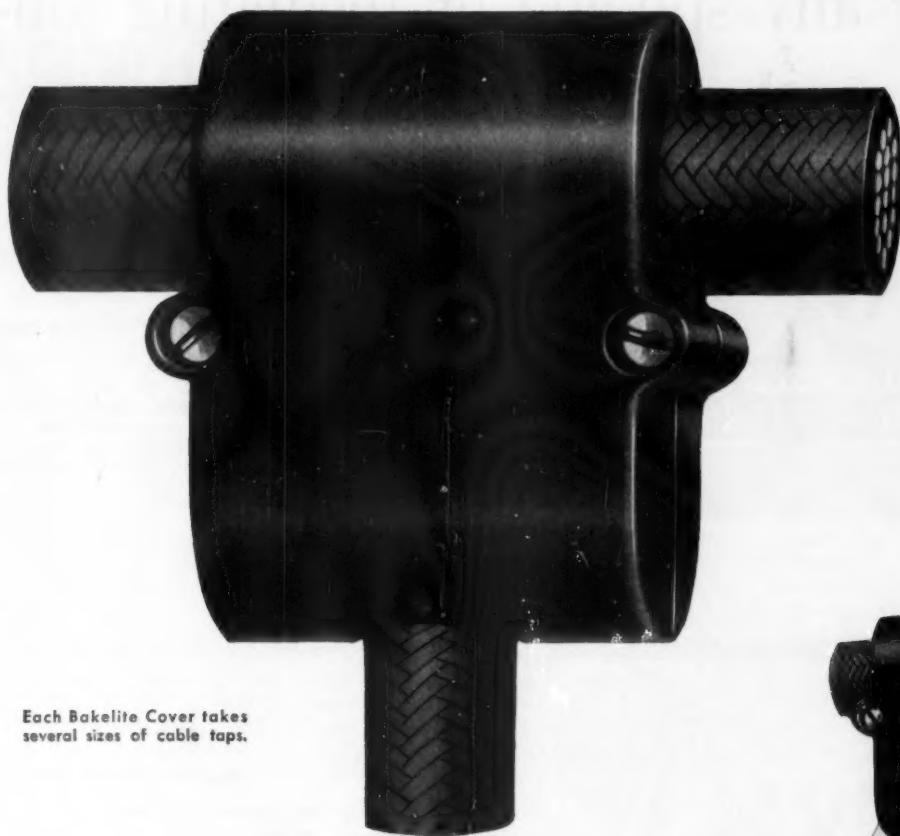


Every Cable Tap can be ordered with or without cover.

PENN-UNION

Originated and fully developed by Penn-Union, the "TYPE PC" CABLE TAPS are widely preferred for a neat, compact connection — that holds tight permanently.

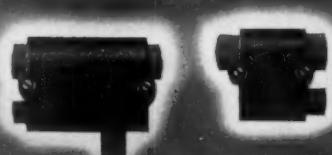
The bodies are high copper content alloy. Large socket-head tap screws. Carried in stock in a complete range of sizes up to 1,000 MCM mains.



CABLE TAPS

MOLDED BAKELITE COVERS, high dielectric and strong mechanically, can be ordered with all Penn-Union PC taps—for 90° and parallel taps in any of the combinations shown, and others such as 4-way fittings connecting two separate mains and two separate branches.

PENN-UNION ELECTRIC CORPORATION • ERIE, PA.



PENN-UNION

Penn-Union Electric Corporation • Erie, Pa.

Send sheets showing full line of "Type PC" Cable Taps.
 Send new Pocket Catalog—complete Penn-Union line.

(Name) _____

(Company) _____

(Address) _____

For any splicing or insulating job— there's a "U. S." Tape



HOLDTITE® FRICTION TAPE

This is the strong, tacky tape that really grips and stays on. The fabric has unusually high tensile strength to handle *any* electrical or general purpose job. Non-raveling, straight-tearing. No pinholes to cause leaks. U.S. Holdtite exceeds A.S.T.M. Specifications.



HOLDTITE RUBBER TAPE

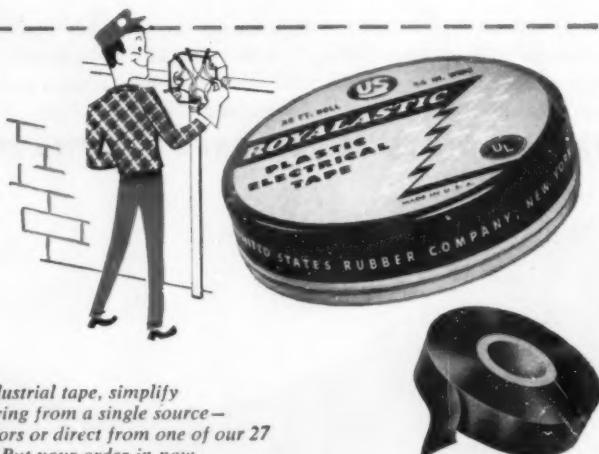
For durable splices on all general electrical work. Holdtite is an unvulcanized rubber splicing compound with high tensile strength, high elongation and tackiness plus dielectric strength. Electricians like its "feel". Easy to handle, pulls down tight and fuses quickly into a solid mass without heat or undue pressure. Insures long-lasting splices. U. S. Holdtite exceeds A.S.T.M. Specifications.

ROYALASTIC PLASTIC TAPE

For making a thin splice and keeping wiring neat and uncluttered, many maintenance men find Royalastic is best. It does the work of both rubber and friction tape in many uses. Complete mechanical and electrical protection. High tensile strength and excellent resistance to abrasion and to water, oils, acids, alkalies and corrosive chemicals. Good stretch, pulls down tight, stays on. Approved by Underwriters' Laboratories, Inc.



*When you need industrial tape, simplify
your purchasing by ordering from a single source—
one of our numerous distributors or direct from one of our 27
District Sales Offices. Put your order in now.*



UNITED STATES RUBBER COMPANY
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Washington Report

The outlook for business is optimistic, maybe actually bright. The going rate for sales, employment, income, savings, power production, new building construction, and many other economic factors at the end of 1954 were near record peaks, and headed upward. While government economists and Washington forecasters were generally cautious, individual reports on nearly all economic guideposts substantiate a certain amount of optimism. Some of these individual reports are summarized below.

- **Industrial output**, as measured by FRB index, hit 129% of the 1947-49 average in December, after trailing 1953 all of last year. Contrary to normal trends, production increased during December. The improvements were more or less general across the board, from mines to factories.
- **Home building** set a new record last November for that month, at 103,000 starts, up 26% over similar 1953 month, BLS reported, down only 3% from October's 106,000. Also, FHA reported receipt of a record number of applications for home mortgage insurance in November, for 52,700 dwelling units. This was 29,000 more than in November 1953, a year earlier, but down 1,750 applications from October 1954.
For first 11 months of 1954 housing starts reached 1,122,800, topping 1953's total for year of 1,103,800. In 1950, the 11-month total of starts was 1,302,800, the record to date, when the full year count was 1,396,000.
- **New building construction** last November was valued at \$3.3 billion, a record for that month, Dept. of Commerce reported. This was 8% ahead of the previous November, with privately financed work valued at \$2.3 billion, publicly financed work at \$1 billion.
- **Capital spending** for new plant and equipment is unofficially estimated at \$26.7 billion for 1954, with forecast for dip of 2% or less this year.
- **Business inventories** at the end of October stood at \$77.9 billion, down about \$4.4 billion from the year earlier record high.
- **Retail sales** in December ran ahead of the similar period in 1953, but volume for the year was estimated to be about 1% below 1953's \$153 billion total. With personal income near record peaks, personal taxes reduced, and personal savings up, outlook for consumer purchases to maintain a high level is excellent.
- **Personal income** last October (last figures available) was at annual rate of \$285.9 billion, \$1.9 billion less than total for 1953, but equal to similar month of that year. Since FRB industrial production index shows increase during final 1954 quarter, further increase in personal income may reasonably be assumed.
- **Living costs** rose a bit for month ending November 15, to 114.6, reflecting impact of higher priced new auto models, BLS reported. If autos are eliminated from the statistics, however, consumer prices actually declined slightly. The new BLS index is .5 below the 1954 peak, .3 below a year earlier.
- **Electricity output** neared the milestone of 10 billion kwhr per week last month, when production hit 9,909 billion kwhr for week ending December 18. This was 11.4% over like week in 1953, 65% greater than production five years earlier. The 10 billion kwhr milestone will probably be reached some time this month.
- **Electrical work forecast** is spelled out in detail in the "Outlook for '55" feature, beginning on page 73.



Take care!

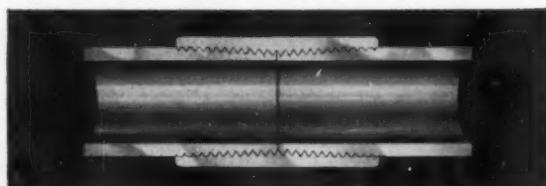
Select **SHERARDUCT**
Galvanized Steel Conduit at its best

Don't let your clients face the costly problem of corroded conduit sometime in the future. Take care now. Install a conduit system that gives wiring lifetime protection . . . National Electric Sherarduct Rigid Steel Conduit.

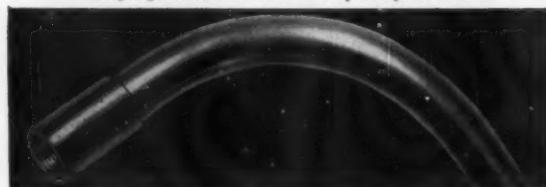
NE's Sherardizing process permanently fortifies Sherarduct against rust and corrosion. Sherardizing actually alloys a zinc coating to the steel conduit providing 100% protection that includes every hill and valley of every single thread. This is galvanizing at its best.

Consider NE's baked-on Shera-enamel for added corrosion protection. Sherarduct's tight, butted joints and easy bending, working, and fishing qualities, and you've got the answer to why Sherarduct is galvanized conduit at its best.

If you're responsible for specifying long-lasting, economical protection for electrical systems in office, factory or home, be sure with National Electric Sherarduct Rigid Steel Conduit.



Coupling threads and surfaces fully zinc protected.



Works and fishes easily . . . bends without flaking.

EVERYTHING IN WIRING POINTS TO

National Electric Products

PITTSBURGH, PA.

3 Plants • 8 Warehouses • 34 Sales Offices



JANUARY . . . at a Glance

HOLIDAY LIGHTING—By all observations and reports, decorative lighting of homes during the past holidays surpassed any previous season. Particularly noteworthy this year was an increased use of floods and spots, in addition to strings of colored lights, to illuminate doorways, applied decorations and symbolic figures.

Decorative lighting at Christmastime is a delightful symbolism that should have every encouragement. But increased loads present potential hazards. Many installations add up to a kilowatt or more. They are almost always amateur jobs connected up with No. 18 conductors. Few homes have outside plug receptacles of adequate capacity so decorative lighting is usually served from a medium base socket in a porch bracket or an entry fixture. In most cases the socket is connected to the circuit wiring in the canopy by small fixture wires.

Substantial danger lies in the possibility of an overload and fire risk at currents below the capacity of the over-current protective device. It is evident that decorative lighting is on the increase and will continue to grow in the years ahead with a consequent aggravation of the problem.

If your local industry group or your own company has a practical plan for consumer education, voluntary inspection or touch-up assistance to reduce

the hazards of decorative lighting, please let us know.

90 YEARS YOUNG—The dean of electrical contractors, L. K. Comstock of New York, is and has been a loved and respected leader in the electrical contracting business for as far back as the memories of even the old, old timers can reach. His active and very full life covers virtually the entire span of the electrical industry. Yet today his lively interests, keen wit and deep wisdom still challenge men of half his age. On January 8 he was 90 years old, a great age for one of the truly great men of the electrical industry. Happy Birthday, Mr. Comstock, and many happy returns.

THE OUTLOOK—Our annual summary and forecast (page 73) for electrical construction activity is optimistic for '55. The signs and the trends are generally favorable. The reports and statistics that provide the source material for estimating the future course of business contain few unfavorable signals for the months ahead.

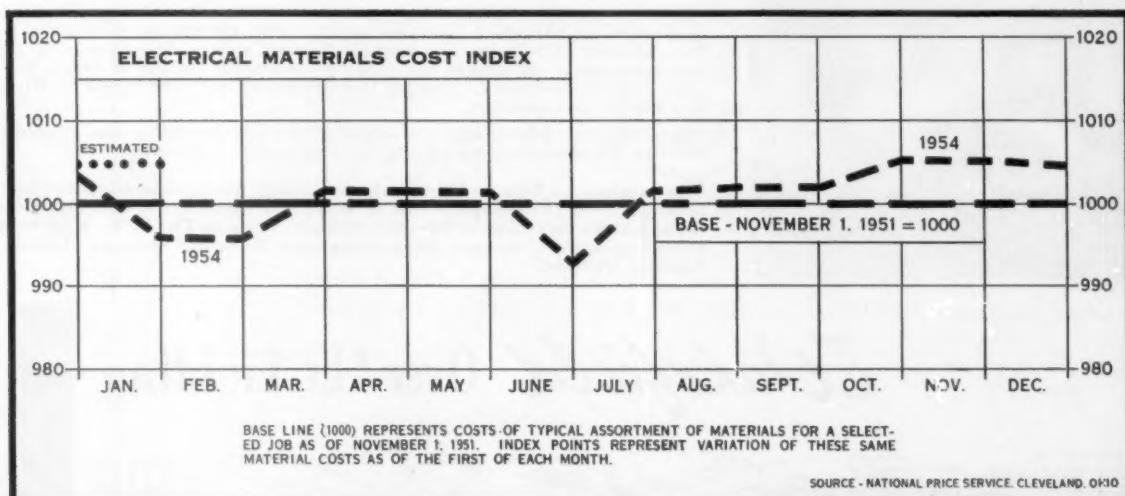
Particularly noteworthy in the '54 year-end statement was the number that took a relatively long look into the future and spoke of objectives five, ten and fifteen years hence. Top industry executives, with responsibilities for tremendous payrolls and vast

investments are not inclined to make such statements off the cuff. They know, better than most, that projects like atomic power, a 10-fold increase in air conditioning sales or industrial automation are not brought into being by stories in the Sunday supplements. Such objectives have to be tackled with very practical capital, engineers, bricks and mortar, skilled manpower, and machine tools long before we can have nuclear kilowatts or air conditioning in every home.

Inherent, too, in reports of long range planning is an abiding faith in the essential soundness of the American economy and confidence in the electrical industry's capacity for great and continued growth.

SOUTH JERSEY CHARGES—The anti-trust action against the New Jersey Chapter of the National Electrical Contractors Association and certain south Jersey members (see "In the News") is a charge by a federal grand jury in due process of law. It is a matter of public record. It has received wide notice in the newspapers.

All the facts on the case are not in. The defense has not been heard. What substance, if any, there is to the charges is for the courts to decide. The industry can only observe and, perhaps, learn whatever lessons there are to learn.





Installed in this modern, attractive interior by The McClure Electric Company were 48 2'x2' Beta units and 10 4'x4' Omega units. Both are completely self-contained units with Wakefield's exclusive Rigid-Arch plastic diffusers. Beta is for recessed mounting and Omega for on-surface mounting. Each comes in four sizes: 4'x4', 2'x4', 2'x2' and 1'x4'.

METROPOLITAN BUILDING AND LOAN ASSOCIATION, Dallas, Tex.

Electrical Contractor: McClure Electric Company, Dallas, Texas.

Licensed Agent: General Electric Supply Company, Dallas, Texas.

Contractor used Wakefield units to increase his sales on this job by \$3200



It is poor business to try always to sell the cheapest. When you sell the best you make more money. And even more importantly you give your client a better result, one both he and you can be proud of.

In the case of this handsome installation of Wakefield Beta and Omega units, E. J. Whitlow, vice-president of The McClure Electric Company, Dallas, Texas, makes these enthusiastic yet logical comments:

"We are proud of this job. The reputation of Wakefield, the appearance of the fixtures and a little selling on our part all combined to increase our sales on this installation by about \$3,200."

"Actually, very little sales effort on our part was necessary. Mr. Gus Berry, President of Metropolitan Building & Loan, has very nice taste. He was immediately sold on the appearance of the fixture and when we explained some of the advantages to him concerning ease of maintenance and some fine construction features he had no hesitancy in recommending to his Board of Directors that the difference be paid for Wakefield over the specified fixture."

"Your Mr. Dan Schisler was very helpful on this job. He went to great trouble to assist us. We congratulate you on your fine representative in this area."

New catalogs on Beta and Omega have recently been prepared. Other new catalogs cover the complete line of Wakefield Geometrics, the Wakefield Ceiling and luminaires of advanced design. Write to The F. W. Wakefield Brass Company, Vermilion, Ohio. In Canada: Wakefield Lighting Limited, London, Ontario.

Wakefield Over-ALL Lighting



WAKEFIELD GEOMETRICS



THE CAVALIER



THE GRENADE



THE PACEMAKER



THE COMMODORE



THE STAR



THE WAKEFIELD CEILING



Modernization is Big Business

Electrical modernization work is on the upgrade, so much so that the electrical construction industry appears to be entering a new phase of activity that could have far reaching effects on its procedures and ways of doing business.

Improvements, modifications and changes in existing electrical systems have always accounted for a substantial amount of electrical business. What has come to be called modernization applies to the type of project which involves a major increase in system capacity to provide for large increases in lighting, air conditioning or other loads. And it is in this class of work that the prospects look exceptionally bright.

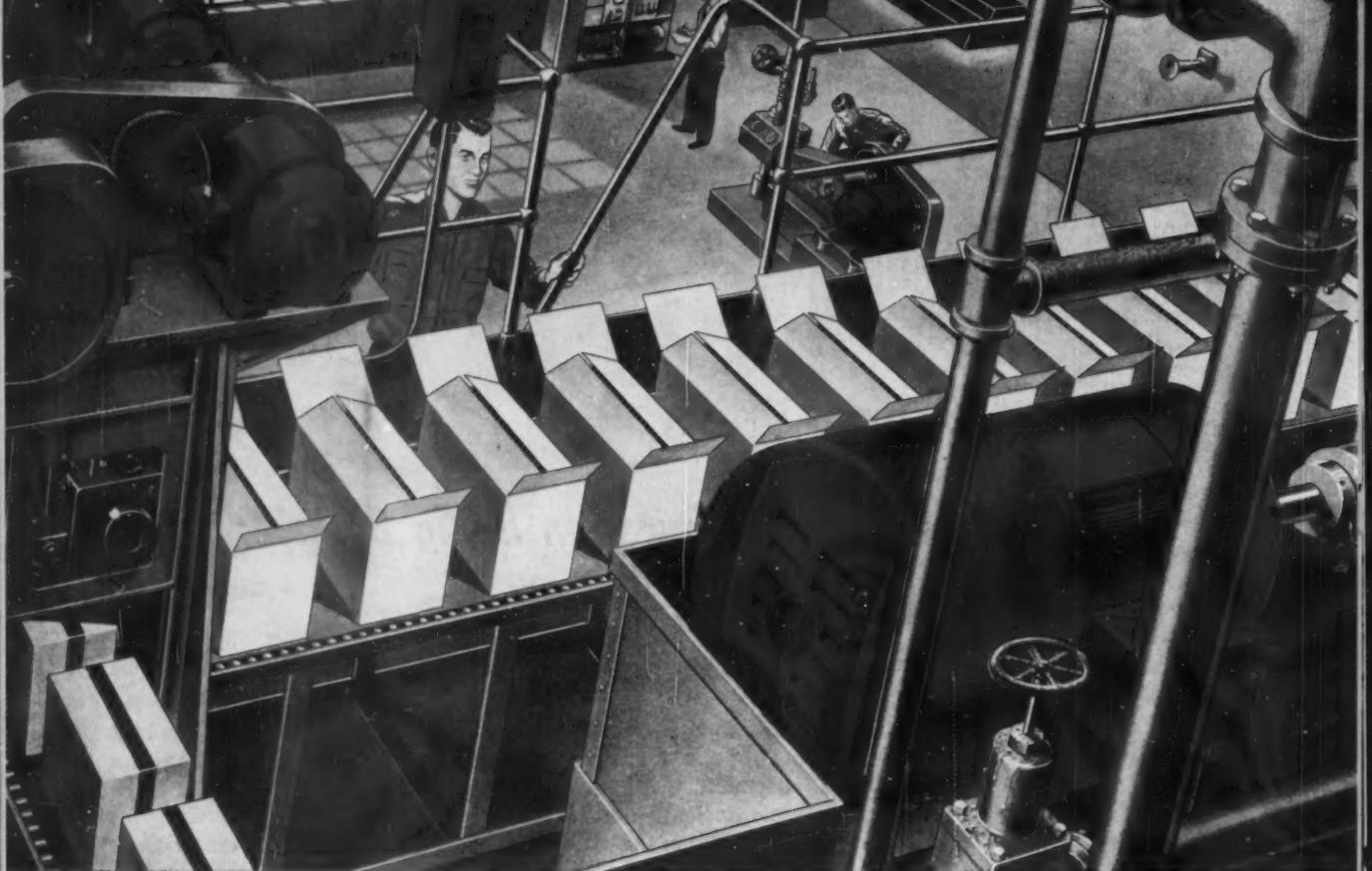
A prophetic indication of what this market can mean is provided in a recent report by a large manufacturer of air conditioning. On central air conditioning for homes the report noted that although "new homes accounted for well over half . . . the greatest expansion occurred in . . . existing homes". On "big" air conditioning for office buildings the report noted further that "the dollar volume for existing office building contracts was more than double that for new structures".

The pattern is particularly significant for the electrical industry because air conditioning is only one of several types of loads that are compelling major electrical system changes in existing buildings. Modern lighting, power for office machines, new elevators, appliances and, in some areas, heating, all impose large loads which require new and larger electrical system facilities.

To the electrical industry, the need for modernization and the market potential is obvious. But traditional construction practices are not readily adaptable to serving this kind of market. Electrical modernization has to be initiated and sold by electrical industry people who have the specialized knowledge to understand and appraise the needs and to propose practical solutions. The electrical contractor is the prime contractor.

New time payment plans are uncorking a lot of residential modernization. There is growing interest in similar plans for commercial work. Utility and industry promotions are growing. But all these are tools. The key to this enormous market is the individual electrical contractor who must eventually, on his own power and sales effort, convert public needs into practical and profitable electrical business.

Wm. T. Stuart



POWER . . . WHERE POWER PAYS OFF. No matter how tough or how special the conditions, Graybar-distributed G-E motors

and controls give you full overload protection, guard against physical damage, electrical breakdown and operating wear.

How to cut down-time . . . step up production

SEND for your FREE copy!



Here in capsule form are the features of the new G-E Tri/Clad '55' motor — its new insulation system . . . new bearing system . . . new ventilating system. See for yourself how better performance and easier maintenance features will save your customers money year in . . . year out.

Here are two practical suggestions: *the first* gives your customers maximum defense against shutdown due to motor failure; *the second* insures reliable nonstop production shift-after-shift.

1. NEW, G-E TRI/CLAD '55' MOTOR — via Graybar. This all-new G-E Motor is built to last longer, perform better. New compact dripproof, rust-resistant cast-iron construction . . . new water shedding silicone stator windings . . . new stronger polyester film insulation . . . higher full load speeds . . . longer bearing life without regreasing.

2. GRAYBAR'S SPECIAL SERVICE ANALYSIS. Do your service conditions demand totally enclosed motors? Variable speed? Gear or reversible? A Graybar Power Apparatus Specialist will work with you in selecting the exact equipment for any machine-drive requirement. Call on him. It will pay off in longer, trouble-free performance. Remember, Graybar distributes the *complete* line of G-E motors and controls.

As a matter of fact, your local Graybar Representative can provide practical application data on more than 100,000 different electrical items. For wiring projects, for instance; or lighting, ventilation and communication; complete information is as near to you as your telephone. 437-41

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IN OVER 110 PRINCIPAL CITIES

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Favorable prospects dominate the apparent trends for 1955

- Electrical work to be up in physical volume and dollar value over 1954
- Construction to establish new records with residential up, commercial up, institutional up and industrial even or slightly down
- Growing load density to require increasing share of the building dollar for electrical work
- Electrical modernization, under pressure from load growth and obsolescence, to reach new levels.

Outlook for '55

Forecasts see more construction activity and growing electrical requirements combining to make 1955 a year of opportunity.

THIS ought to be a good year for business, better than '54, maybe as good as '53. For the electrical industry it will probably reach new highs across the board; kilowatt hour sales, equipment, apparatus and appliance sales and electrical wiring system installations. These predictions are indicated by historical patterns and the position and direction of authoritative business indexes and judgments at the close of 1954.

The outlook on '55 is unique because there are so few adverse factors upon which the forecaster can build a comfortable hedge. There's worry about agriculture and farm prices. Such

worries could affect the farmer's role as a buyer of wiring, electrical machinery and appliances. There is a carry-over of last year's room air conditioner inventory into the '55 season. But '54 was a "cool" summer in some of the best markets.

But such adverse factors seem to be isolated, individual signs without systematic interconnection. On the other hand, the favorable signs are strong and substantially supported and related.

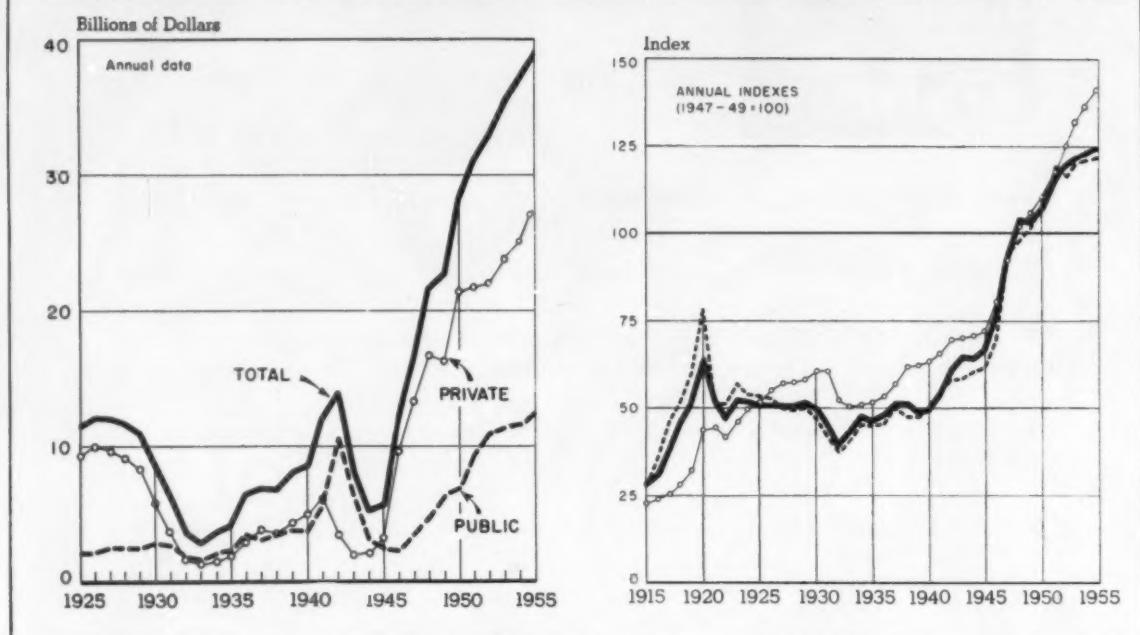
Construction, for example, can be estimated on the basis of the established trends. Or we can look at the prospects on the basis of the backlog

of projects planned. Either method would support a favorable forecast for this year. And construction necessarily entrains a growing proportion of electrical work as utilization requirements increase.

In figures, electrical construction potential for 1955 looks like it will total \$3,214 millions or about 7½% above 1954. In breakdown, residential will be up, industrial about even or somewhat down, commercial and institutional substantially up.

The accompanying table develops electrical work potential from Department of Commerce projections of 1955 construction volume.

CONSTRUCTION VOLUME—CONSTRUCTION COSTS



VALUE OF NEW CONSTRUCTION in current prices. In the second graph, the heavy line is construction costs; the broken line, material prices and the light line with circles, union wage rates.

Residential

Residential work, usually half of all private construction, is the subject of some differences of opinion among forecasters, but most are optimistic. The Department of Commerce sees an increase of 13% this year over '54 reflecting continued strong demand plus easier terms. The 1,300,000 housing units (public and private) expected to get under way in 1955 are second only to 1950 when construction was started on 1,400,000 homes. The Housing Act of 1954 will have a marked effect on home building this year.

The electrical work potential in new residential construction is expected to be influenced upward by more industry promotion devoted to up-grading standards from minimum "safety" levels. Adequate Wiring promotion has been expanded and is expected to gather stronger local support as well as parallel industry support in 1955. While "adequate" or "functional" wiring designs represent a relatively minor additional unit cost per home to the builder, they are a vitally important gain for the electrical contractor and the electrical industry.

The big problem remains—how to translate what the industry knows to be technically essential into mortgag-

able values to the appraiser, salable features to the builder and recognizable use-benefits to the home buyer.

It could be a big year for residential lighting. With promotion like Light Conditioning and handsome lighting effects from built-ins showing in the shelter publications, prospects are hopeful, and the public receptive. After a generation of box-cover lamp-holders and two dollar ceiling fitters setting budget standards for lighting, however, even a modest ticket for a piece of functional built-in lighting or modern lighting effects looks outrageous to the builder.

Commercial

Current prospects are that commercial, religious and educational construction will continue upward to set new records in 1955. New stores, shopping centers, schools, churches and community buildings to serve the rapidly expanding suburban developments will be important factors in the expected growth.

Electrical prospects in commercial-institutional categories are even better than would appear from over-all construction forecasts as a result of the rising load density, or watts per square foot, of modern commercial and institutional building require-

ments. Better lighting and air conditioning are the primary influences and both are on a rising trend line.

Public utility expansion is continuing on a long-range program that will hold fairly even through 1955. Declines in railroads and gas will be offset by gains in electric power and pipelines.

Industrial

While the Department of Commerce predicts that industrial construction will decline moderately for the third successive year, the trend has flattened out in recent months and could turn upward. The McGraw-Hill survey of plans for capital expenditure disclose that 1955 prospects for new plants, equipment and modernization are within 5% of 1954.

Over four-fifths of the \$15 billion of manufacturing plant expansion certified for accelerated tax amortization since 1950 has already been put in place. But new non-ferrous metals, chemical, steel and food processing plant expansion, plus increased outlays for modernization of existing facilities have been factors in slowing the decline in industrial construction.

Like commercial, the electrical share of industrial construction is rising. Higher lighting levels, more power in machines and processes, more mech-

TABLE I

Electrical Work (in millions of dollars)	1953	1954	1955
Private			
Residential	584	615	645
Industrial	322	302	272
Commercial & Institutional	325	372	446
Farm	74	81	80
Utility	354	336	350
Other	7	5	5
Public			
Residential	22	8	5
Industrial	192	236	213
Educational	180	240	264
Hospitals & Institutional	63	42	44
Other	30	30	30
Military	70	42	40
Highways, conservation and other works	120	180	180
	2,343	2,490	2,574
Maintenance & Repair	548	600	640
	2,891	3,090	3,214

anization of materials handling and the rapid growth of automatic control, primarily electrical, is increasing the ratio of electrical work in industrial plant construction.

Modernization

If home electrical systems are to catch up with the multiplication of appliances and higher lighting levels demanded by today's electrically-operated existence, it will probably have to be accomplished through time payment buying of expanded wiring systems. This prediction, expressed by L. E. Barrett, plan committee chairman, National Adequate Wiring Bureau, represents current thinking by many industry spokesmen on means of attacking the enormous home wiring modernization potential.

During the past year, Cincinnati's favorable experience with a time pay plan has aroused nation-wide interest and many such plans are in operation or in the making for 1955.

While there is a good pace in commercial modernization which is expected to persist into the indefinite future, such projects could be multiplied many times before they would begin to catch up with actual current needs in existing buildings for lighting and air conditioning.

These awards should go up to \$15.2 in 1955, a rise of 6%. Private contracts at \$8.1 billion, up 1%; federal at \$1.3 billion, up 10% and state and municipal at \$5.8, up 12% are the gains expected.

Back of these predicted increases is a \$76.4 billion backlog of projects proposed which are moving up to the contracting stage. New projects pouring in will total \$14 billion while \$6 billion will move out into contracts. These are identified individual projects on record.

President Eisenhower's \$50 billion 10-year highway program will get some financial blood poured into it. The St. Lawrence Seaway and power projects will not only get rolling themselves but will also touch off harbor terminal and industrial construction throughout their area.

Appliances

Trends in electrical appliance sales give important clues to wiring requirements. Authoritative *Electrical Merchandising* says, "Prospects for 1955 look exceedingly bright, with a possible 10-20% increase over 1954 business".

Like many other consumer goods industries appliance sales were off in the first three quarters of 1954 but last quarter figures were running substantially above those set in the earlier months. The newer devices, however, such as air conditioners, dishwashers and clothes dryers all showed healthy gains.

Heavy current appliances which normally require special circuits all gained except ranges during the first nine months of 1954 over 1953:

Air Conditioner, Room	+ 25%
Dishwashers	+ 25%
Dryers	+ 15%
Ranges	- 10%

Among important trends, room air conditioners broke well over the 1,000,000 mark in 1954 despite an abnormally cool selling season and should hit 1,500,000 in 1955. The trend to "built-in" kitchen equipment continued to intrigue builders and may pose a challenge to conventional range and refrigerator design.

Power

Despite the economic recession, the electric utility industry saw only a slight dip in its capital outlays in 1954, while it continued to set records in total energy sales production and customers.

Electrical World's most recent forecast indicates a total of \$4,007 million in capital expenditures by the utilities

for the year, down just \$55 million from the record spending in 1953. Similarly, 1955 will show a slight decline, evidencing a trend toward tapering the budgets for generating facilities in advance of a lower level of capacity additions in 1956 and 1957. Expenditure for transmission facilities, which follow the pattern set by generation needs, will also be falling off a bit.

Distribution expenditures on the other hand, will be going up. Reasons for this are the continued healthy strides both in the numerical increases in residential and small light and power customers, and in the accelerating usage in terms of kwhr per customer.

A study of the increase in residential sales of 1953 over 1952, revealed that over 77% of it came about from increased saturation of appliances. What makes this particularly significant for the years ahead is that the appliances that are the least saturated now, are by and large the heavy users of electricity—room coolers, dryers, heat pumps, and space heaters.

The overall position of industrial power demands is strengthened by the long-range trend of an increasing ratio of kwhr per point of the FRB manufacturing index. This will continue to be the case in spite of occasional reverses. Industry's researches toward greater efficiency inevitably mean more mechanization, and this, coupled with the relatively slow rise in production man-hours (increases in the labor force being offset by the trend toward a shorter work week) mean a greater need for electric power.

But two other factors also contribute to increased needs of industry. One is the growth of metallurgical production with its excessive power demands, in particular, the aluminum and magnesium industries. The other, though not really relevant in a discussion of industrial production, is industrial air-conditioning, more and more a factor in the modernization and construction of new industrial establishments.

Summing these individual categories of energy sales, and adding in the miscellaneous category, a total of 405.6 billion kwhr was sold in 1954, an increase of about 21 billion over 1953. To provide this power, the major electric systems (class I) generated a total of 467.3 billion kwhr.

Load factor was down slightly from 1953's 64.0% to 62.5%, again a reflection of the drop in industrial production.

An industry milestone was set some-

time in December when the 100 millionth kw of capacity was installed. The year end total stood at 103 million kw. Peak load rose to 85.2 million kw, with the beginning of a new pattern in summertime peaks as the air conditioning load began to be felt more and more.

The National Economy

In addition to new building construction, modernization, electric power growth and expansion, and electric appliance markets, there are also many other economic factors which affect electrical work. Their analysis will also help point up what's ahead, both short and long range.

Economic factors already covered all contribute to the state of the nation's business. Likewise, the state of the national economy influences the electrical construction business, as well as new building construction, electrical equipment markets, electric power expansion, etc. Some of the more important economic factors are population growth, gross national product (GNP), industrial production, national and personal income, employment, cost of living, and several others. Analysis of some of these factors provides a clue to the national economy ahead, and to its impact on electrical construction business.

Population Growth

An economic factor of key importance to businessmen is population growth. This factor has two major effects on the economy: 1) it provides a labor force to support increased production, and 2) it provides an expanded consuming market for the goods produced.

In 1900 the U. S. population totaled about 76 million people. By 1925 it had reached 114 million, or an increase of about 1.5 million per year, while by 1950 it totaled 151.7 million. Population doubled in 50 years. But in 1950, the increase per year was at a rate of more than 2.5 million. It is estimated that in another five years, by 1960, the population will be in excess of 175 million, and that by 1970 it will be over 200 million. This means that 40 million more customers will come into the market over the next 15 years—customers for homes, electric appliances, more electric power, more durable and non-durable goods of all types.

Gross National Product

The amount of goods we produce and consume has about doubled every 25 years. The value of goods and serv-

ices produced annually are used by economists as a measure of the economy, and is called the "gross national product", GNP has been increasing at an average rate of almost 3% per year since 1930, or from \$55.8 billion in 1933 to \$367.2 billion in 1953. The GNP in 1954 dropped about 3% from the 1953 rate to an annual rate of \$356 billion at the end of September. It has since increased, and is now crowding the record 1953 peak rate once again.

Industrial Production

Production is slowly climbing back within striking range of its peak record of 137 reached in 1953, after having lagged during most of 1954 at around 124, as measured by the FRB index using 1947-49 average as 100. The average for 1952 was 124, so industrial production last year was comparable with two years earlier. But the year ended at an FRB index rate of 128.

Going back for comparison, FRB index for 1945 was 107, and for 1940 was 67. Production in 1951 was measured at 120, and in 1950 at 112. Pre-war, the record was 41 in 1920, 49 in both 1925 and 1930, and 47 in 1935. Thus physical volume of industrial production last year was 85% greater than in 1940, and 16% greater than in 1945.

On the other hand, if population is taken into account as it should be for each economic factor, per capita industrial production last year was only 1% above the average for 1947.

Income

Personal income has been running at a rate of about 78% of GNP over the past several years. Last year this percentage increased about two points, reflecting both continued good wages and high levels of employment. Last September's income level was at an annual rate of \$287.5 billion, or less than 1% below the record high of \$288.2 billion reached in July 1953. Compared with the \$72.9 billion income of pre-war 1939, the current personal income rate is nearly four times (up nearly 300%) as high. It is also about 62% higher than the \$178 billion tallied in the first post-war year of 1946.

Personal income less personal taxes accounts for total disposable personal income. With Federal personal taxes having been decreased an average of about 10% during 1954, both disposable income and personal savings have increased. Estimate for late 1954 put personal savings in excess of a \$20

TABLE II

CONSTRUCTION¹ IN MILLIONS OF DOLLARS

PRIVATE	1951	1952	1953	1954 ²	1955 ³
Residential					
New Units	9,849	9,870	10,350	11,890	13,475
Add. & Alt.	934	1,045	1,100	1,120	1,200
Non-housekeeping	190	185	250	295	325
Non-residential					
Industrial	2,117	2,320	2,150	2,000	1,850
Warehouse-office-loft	544	515	680	995	1,000
Stores-rest-gar.	827	622	970	1,200	1,300
Religious	452	399	450	585	675
Educational	345	351	400	560	650
Social & rec.	164	125	300	210	225
Hospital & inst.	419	394	150	335	400
Misc.	284	288	300	295	300
Farm	1,646	1,610	1,475	1,560	1,450
Utility	3,729	4,003	4,430	4,400	4,425
Other private	64	85	130	120	125
Total private	21,564	21,812	23,135	25,525	27,400
PUBLIC					
Residential	595	654	560	340	250
Non-residential					
Industrial	946	1,667	1,920	1,570	1,050
Educational	1,513	1,619	1,500	2,070	2,400
Social & rec.	107	51	50	50	na
Pub. Admin.	179	123	125	150	na
Hospital & inst.	528	473	355	350	400
Misc. non-res.	196	186	100	615	600
Military	887	1,388	1,400	935	1,100
Sewer & water	716	692	750	975	1,050
Highway	2,518	2,860	3,150	3,550	4,200
Misc. public	213	193	190	200	215
Conservation & dev.	853	854	865	720	675
All other	80	66	100	150	160
Total public	9,331	10,826	11,065	11,675	12,100
Total	30,895	32,638	34,200	37,200	39,500

NOTES:

¹Source: Department of Commerce²Estimated on 9 month report³Estimated

na — not available

billion annual rate, and disposable personal income at a rate of slightly more than \$250 billion annually.

Employment

Employment has grown slowly but steadily from 52.8 million workers in 1945, at the end of the war, to 62.2 million in 1953. In August of last year it stood at 62.3 million, after having dipped earlier in the year. Normal growth in the labor force ranges between 500,000 and 700,000 per year, but the nearly 10 million workers

added over the nine year period between 1945 and 1954 also included military personnel returned to the civilian economy.

Much ado was made over unemployment during 1954, particularly during the first half of the year. But analysis of unemployment statistics from 1929 to 1954, and of factors affecting unemployment, reveals that the situation was not critical as indicated. For example, unemployment in 1929 was about 1.8 million, when the total U. S. population was 12 million. Thus 1.5%

of the entire population, employables and unemployables alike, was unemployed at that time. From 1929 to 1933, unemployment rose rapidly to about 12.5 million, or to about 10% of the entire U. S. population. Then unemployment declined slowly until 1944, at which time it began to rise again. In 1944 unemployment was down to about 900,000, or .6% of the entire 1944 population. At the end of 1941, unemployment, on the decline from the 1933 peak, was still about 5.0 million which the war trimmed to 900,000 over the next three years.

Postwar unemployment climbed to 3.1 million in 1949, or 2.1% of total population, then declined slowly to 1953 when it reached a low of 1.5 million, or .95% of total population. During 1954 there was a sharp climb to approximately 3.7 million unemployed in February, or 2.27% of the total population. It has since declined slowly, and now stands at around 2.9 million unemployed, or 1.77% of the total population.

Cost of Living

The Bureau of Labor Statistics' total cost of living index has fluctuated only slightly since 1952, ranging only from 114.3 in August 1952 to a high of 115.4 in 1954. The low point for 1954 was 114.6 in April, and the high was 115.4 in October, all as compared with 100 for the 1947-49 average.

With personal income at near record levels, and costs of living remaining nearly constant over the past two years, the purchasing power of individuals is the highest on record. This was true during 1954 notwithstanding all that was written and said about the recession of business during the year. Total personal income receded very little from the high of the last half of 1953, while personal taxes were substantially reduced, and cost of living remained stable. Disposable personal income was nearly \$20 billion higher than in 1952.

These and many other economic factors combine to point to an upturn in the national economy, and in the electrical construction field. They all reflect continuing growth in population, income, savings, employment, production, wholesale and retail sales, and business optimism. Nothing spectacular is indicated. But it is significant that the 1954 recession has been stopped and headed back upwards, and that most economic factors have undergone their normal adjustments. All these appear to point to a sound and stable basis for a moderate upturn in business in the year ahead.



AERIAL VIEW of the plant shows the high tension yard at extreme left end of building. Rectifier building adjoins the yard and runs the width of the plant, diagonally down from left to right in the picture. The large reduction cells are lined up in series along the length of the two long plant buildings.

Power for Aluminum Production

Installation details of the extensive distribution and rectification system supplying 10 kwhr of energy for every one of the 110,000,000 pounds of aluminum produced yearly at a large plant of the Reynolds Metals Company, Arkadelphia, Ark. Electrical construction was done by Fagan Electric Co., Little Rock, Ark.; consulting engineering, by J. Gordon Turnbull, Inc., Cleveland, Ohio.

By John Kiefer, *Plant Engineer, Reynolds Metals Company, Arkadelphia, Ark.*

A HEAVY, round-the-clock flow of electric power is vital to operations at the Robert P. Patterson Aluminum Reduction Plant of the Reynolds Metals Company, Gum Springs, just South of Arkadelphia, Arkansas. Here, 110,000,000 pounds of pig aluminum are produced yearly by an electrolytic process which consumes dc energy at the rate of 100,000 kw. Many complex and unusual construction details are involved in the overall plant electrical system which includes outdoor substations for incoming ac, rectification equipment and distribution

buses for the dc power to the potline.

The reduction process which requires such an elaborate electrical system is basically simple. The Reynolds Hurricane Creek Alumina Plant, located at Bauxite, Arkansas, about forty miles away by rail, furnishes the Patterson plant with three important raw materials—alumina, alumina fluoride and cryolite. Alumina (refined bauxite ore) is first dissolved in molten cryolite in a reduction cell, or pot. The solution is electrolyzed by direct current, separating aluminum from the alumina. The aluminum is heavier

than the electrolyte and sinks to the bottom of the cell. It is then vacuum syphoned into crucibles and cast into pigs.

The Patterson plant has a total of 160 Soderberg reduction cells connected in series and rated at 125,000 amperes; eighty cells are set up in each of two cell rooms. Continuous, uninterrupted power flow is required, otherwise the cell contents freeze, and great expense and considerable time is involved in restarting the line. About 10 kwhr of energy is required to produce each pound of aluminum.

High Tension Yard

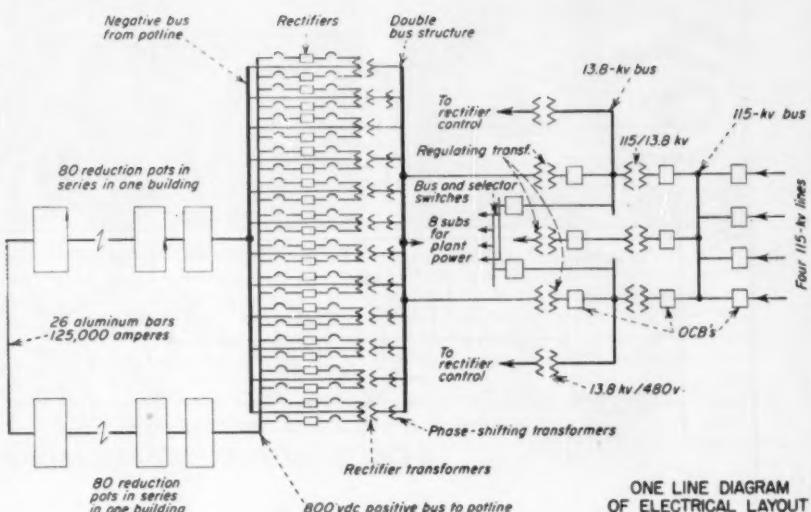
All power comes into the plant at a high tension yard at one end of the plant. Four 115-kv, 3-phase lines come into the yard from aerial transmission lines supplied by four separate utility power stations. Each of these lines is connected through a disconnect switch and electro-pneumatically operated 1200-ampere, 115-kv OCB, rated at 3,000,000 kva interrupting capacity, to a common 115-kv bus.

Power from the 115-kv bus is fed through gang operated disconnect switches through three OCB's to three 115-kv/13.8-kv stepdown transformers. Each stepdown transformer is inert gas sealed, oil cooled and rated at 40,000 kva. These transformers are equipped with two stages of fans which give each transformer supplemental ratings —53,333 kva with first stage forced-air cooling and 66,667 kva with second stage forced-air cooling. Two $2\frac{1}{2}$ taps below and above 110 kv are provided on each transformer. During an emergency, any two of these three transformers can, with second stage forced-air cooling, carry the entire load of reduction cells.

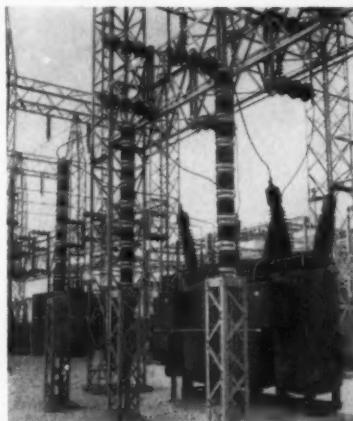
13.8 KV Power

From the stepdown transformers, 13.8-kv power is supplied through three electro-pneumatically operated deion grid, 3,000-ampere OCB's to three regulating autotransformers rated at 40,400 kva each. Each of these transformers is equipped with oil circulating equipment to raise the output to 53,800 kva with first stage fans and oil circulating equipment in operation and to 67,300 kva with second stage fans and oil circulating equipment in use. Again, only two of the three regulating transformers can carry the full load of the potline in an emergency, using second stage fan cooling and oil circulation.

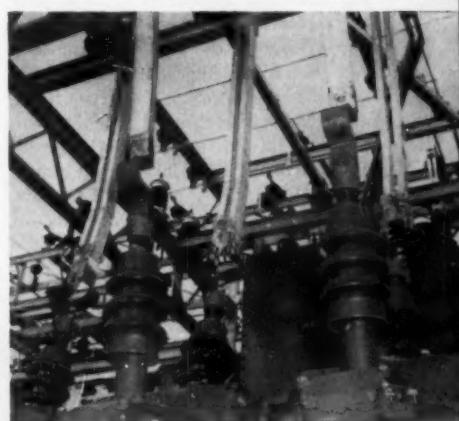
The cooling system for each transformer consists of radiators equipped with fans for forced air cooling. The radiators and transformer windings are arranged for forced oil circulation. Normal voltage is 13,800; load voltage may be varied from 15,180 to 1,620 volts. A no-load tap changer is provided to give the following full load terminal voltages in seven equal steps —13,800; 12,000; 10,200; 8,400; 6,600; 4,800; and 3,000. The under-load tap changer provides plus or minus 1,380 volts of normal voltage in 32 steps for each no-load tap, giving a total range from 15,180 to 1,620 volts.



ONE LINE DIAGRAM OF ELECTRICAL LAYOUT



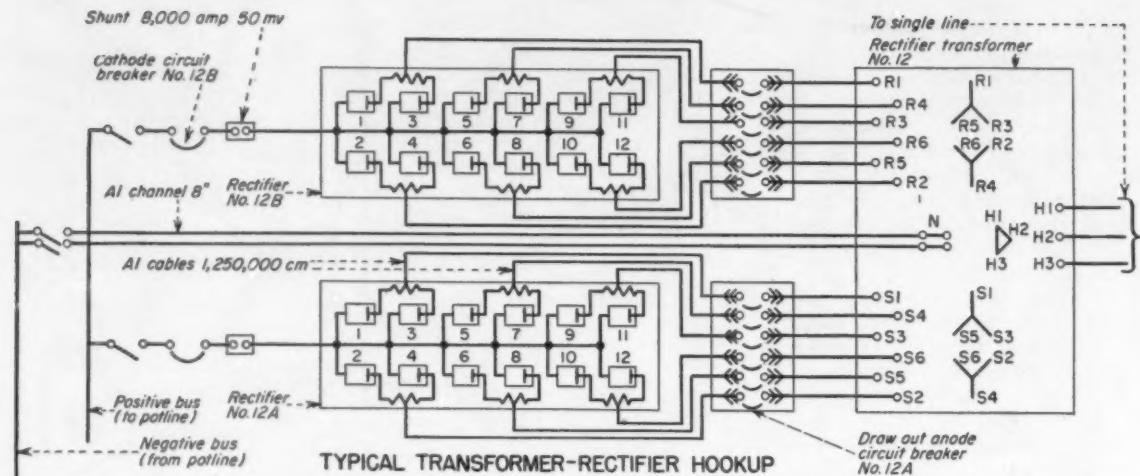
INCOMING POWER from one of the four 115-kv 3-phase lines serving the plant comes through disconnect switches mounted on structure in top of photo. From the load side of the switches, the three phase cables run to the top of the three lightning arresters shown in foreground, then through 1200-amp, 3,000,000-kva OCB unit.



TERMINAL DETAILS are shown here on one of the OCB's feeding power from the 13.8-kv bus to a regulating autotransformer. Aluminum bars are used between the overhead bus structure and the insulators, with short expansion sections of leaded copper. Aluminum bar is used widely throughout the plant for both current-carrying and structural parts.

The output of the three regulating autotransformers supplies a variable voltage double bus through 3-pole, gang-operated selector switches mounted on top of the bus structure. The bus supplies twelve ignitron rectifier transformers through 3-pole selector switches. There is a phase shift transformer in the line to each of ten of the rectifier transformers; four of these shift 5° , four shift 10° and two shift 15° . This combination of phase shift transformers and twelve rectifier

transformers, six connected primary delta and six connected primary wye, gives overall station operation at 72 phase. The arrangement of phase shifting transformers is such that when all three ac lines are normal, each line supplies a 24-phase bank. If only two lines are available, alternate numbered units are connected to the top member of the double bus and the remaining units are connected to the bottom member of the double bus. Under these conditions, each ac line feeds a 36-phase bank.



The rectifier building is a two-story reinforced concrete structure, adjoining the high tension yard. The long high center section of this building houses the rectifiers. Wings on each end of the building house the duplex control board, offices, battery room, meter shop and storage. Balconies are provided in each wing above the operating floor level to house Precipitron units which supply clean building air.

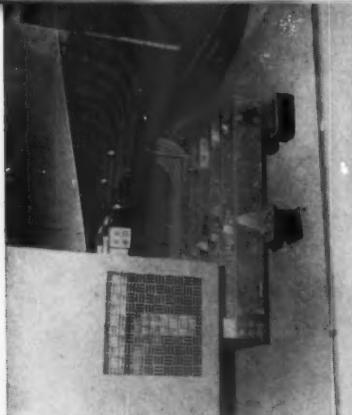
Conversion apparatus consists of twelve ignitron assemblies fed by the twelve rectifier transformers. Each as-

sembly consists of two twelve-tube ignitron rectifier groups. Each twelve-tube group is fed through an anode circuit breaker and is rated at 5,208 amperes—10,416 amps for each assembly. Each rectifier group connects through a high-speed dc cathode breaker to the common dc collector bus from which the 125,000 ampere potline is supplied. Normal dc voltage is 800. By means of a combination of no-load taps and tap changer under load autotransformer, it is possible to vary the dc voltage from 800 volts down to 95

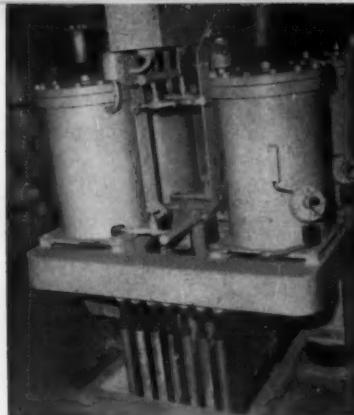
volts, the voltage for rectifier degassing and reduction cell baking-out. The range of the autotransformer is such that the dc voltage can be increased above 800 volts, but this is only for compensation of the high line voltage regulation. Under all conditions, the load to the series line of reduction pots is 125,000 amperes. Due to the possible outage of one complete ignitron assembly, the other eleven assemblies are capable of carrying normal load, giving them an equivalent rating of 11,363 amperes each.



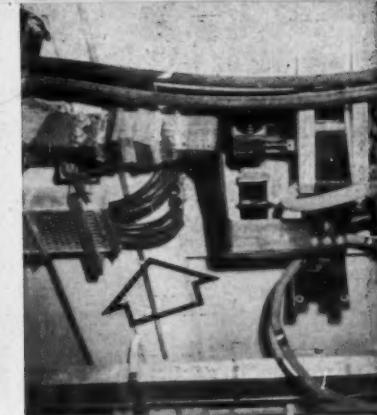
RECTIFIER ROOM takes up most of the rectifier building adjoining the high tension yard. Twenty-four groups of twelve ignitrons each are lined up down the center of the room. Each rectifier transformer feeds two groups of ignitrons. Pipes for water cooling of the units can be seen at the right end of each group. Rectifier auxiliary control cubicles and unit control cubicles are lined up along the wall at left. Cubicles are supplied from plug in busway running the length of the room just above the cubicles at left. Trolley bus runs the length of the room along the wall at left, providing power for a traveling crane which can be seen in the background. Two closely-spaced 8-in. aluminum channel bars come through the wall at right from the neutral of each rectifier transformer, run up the wall, across the room along the ceiling, down the wall at left and down to the potline negative bus. Disconnects are used in the runs down the wall at left, just above the plug-in busway (see inset). Industrial type, 4-foot fluorescent fixtures are chain-suspended from the ceiling in this area.



SIX PHASES from half of one of the rectifier transformers come through the wall (right) from the outside yard. The aluminum bars are connected to individual drawout anode circuit breakers within the cubicle shown partially (bottom left). Insulated aluminum cables, 1,250,000 CM, are connected in multiple as shown to the load side bus bars coming up out of the breaker enclosure. These cables feed the ignitrons in the rectifier room above.



IGNITRON UNITS are grouped in twelves on mounting racks (closeup of one end of a rectifier group is shown in photo at left). The rack straddles an opening in the concrete floor through which the ignitrons are fed from the anode CB and through which the output of the ignitrons is fed down to the potline positive bus through a cathode CB. Bushed conduit runs sticking up in the foreground carry aluminum control cables from the control cubicles in the rectifier room. Photo at right shows the underside of floor opening under the rectifier group. Bus running to left carries output of the ignitrons through a cathode breaker to the potline positive bus. Insulator clamps on channel framing are used to support the cable runs to the ignitrons. Cable troughs on trapeze hangers are also used as shown at arrow (this is the underside of the conduit shown in the foreground in the photo at left).



A water to air heat exchanger is furnished to cool each group of ignitrons. The complete cooling system for a group of rectifiers includes a motor driven circulating pump that continuously circulates water through the ignitrons and heat exchanger when the station is in operation and a radiator with 2-speed motor operated fan. The heat exchangers are located on the roof of the rectifier building.

A multi-section duplex control switchboard assembly is provided for the apparatus necessary to effect man-

ual control of the anode-cathode circuits of the potline rectifier setup, the 13.8-kv and 480-volt circuits. Equipment is also included to control, supervise and protect the 115-kv circuits and apparatus in the 120,000-kva, 115/13.8-kv stepdown substation. This 36-ft. multi-section switchboard is located on the second floor North wing of the rectifier building.

Floor mounted rectifier auxiliary control cubicles are lined up along one wall of the rectifier room—one of these cubicles for use with each of the

twenty-four groups of ignitrons. Each cubicle houses complete excitation equipment including reactors, Rectoxes, capacitors, phase shifting reactors for voltage control, automatic vacuum control and indicating equipment, insulating transformers, type AB breakers and line-starters for auxiliary power supply circuits. Mounted between pairs of the auxiliary control cubicles are metal enclosed unit control cubicles, one for each of the twelve rectifier assemblies.

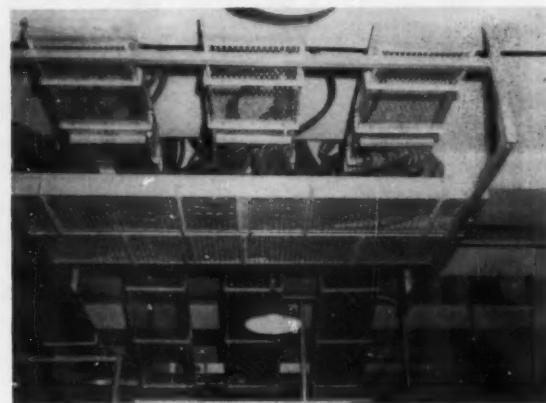
Power for control equipment is pro-

BREAKER ROOM below rectifier room houses 24 anode circuit breakers in enclosures (right) and 24 cathode circuit breakers (left). Openings in the ceiling of this room allow passage of cable to and from rectifier groups which are located directly above the aisle shown in this photo. Inset shows a typical cathode CB fed from above by bus from rectifier. Breaker feeds positive potline bus through disconnect on wall, then through wall to bus tunnel.





ALUMINUM BUS feeding line of reduction cells is supplied through the cathode breakers and consists of 26 aluminum bars, each 12-in. by 1½ in. All joints are Aircomatic welded. The bars are supported by I-beam sections bolted between the walls of this narrow tunnel.



CABLE TRAYS are used extensively to provide easily accessible raceway for control wiring to rectifiers. Trays are supported at various levels by framing-channel hangers, allowing flexible circuiting. Runs of trays were readily adjusted for up or downward slope to conform to structural details.

vided from two 750-kva, 3-phase, 13.8-kv/480-volt delta connected auxiliary control transformers, provided with two 2½% plus or minus no-load primary taps. Each transformer has sufficient capacity to supply all station rectifier auxiliaries. The transformers are supplied from 13.8-kv feeder No. 1 and feeder No. 3 through 13.8-kv Deion fuses mounted in the 13.8-kv structure. The 480-volt secondary line from each of the transformers is carried through an electrically operated

ACB in low voltage switchgear on the operating floor of the rectifier building to indoor plug-in busway provided with an electrically-operated tie circuit breaker in the center of the station. This busway is mounted against the building wall from the North to the South end of the building. The three CB's are electrically interlocked.

From the load side of the rectifier equipment, 125,000 amperes at 800 vdc are transmitted to the line of reduction pots by aluminum buses. Each bus con-

sists of twenty-six aluminum bars, each bar 12 in. by 1½ in. in cross section. All joints in the buses are Aircomatic welded (inert gas). A total of approximately 6,000,000 pounds of aluminum were used in the construction of the bus bar system. Throughout the plant, all control cables and power cables are aluminum. Sizes vary from No. 1 up to 1,250,000 circular mils. Compression type fittings were used on all cables and control wiring in a manner prescribed for aluminum.

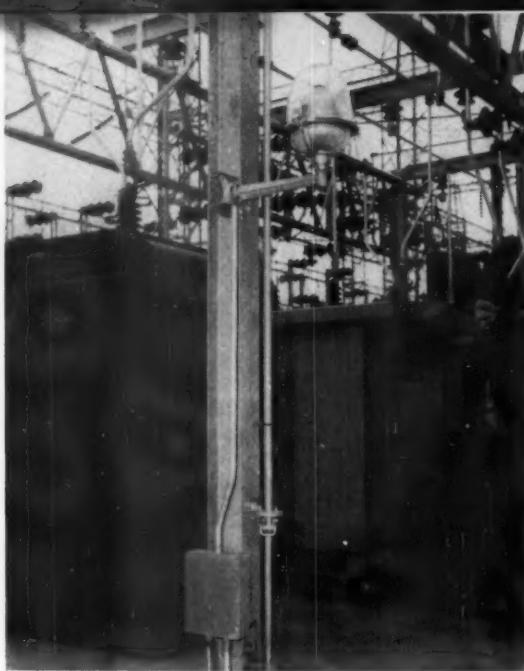
General Power

Power for general plant operations is supplied by eight 1000-kva substations. These substations are fed from 13.8-kv feeders No. 1 and No. 3 through 600-amp gang operated disconnect switches, through electro-pneumatically operated, 1200-amp, 1,000,000-kva interrupting capacity OCB's to two 13.8 kv auxiliary plant power buses. From these two buses, power is delivered through eight single-throw 3-gang operated selector switches to pairs of 1000-kva substations. The two OCB's feeding the buses are electrically interlocked to allow closing of only one OCB at any one time. Interlocked aluminum armored cables are used to transmit 13.8-kv power from the 13.8-kv bus to the primaries of the 1000-kva transformers.

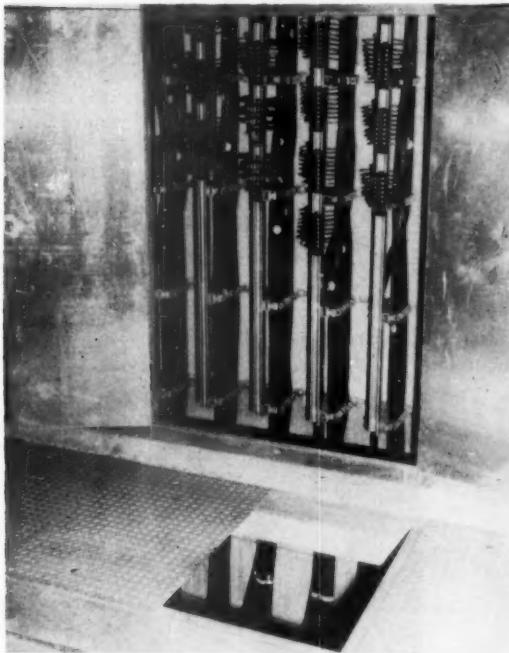
The transformers in the substations are Inerteen-filled for indoor service



M-G SET is one of three such units used in the rectifier building to charge two heavy-duty control batteries, each 60 cells, 125 volts, rated 160 ampere-hours and 272 amperes discharge. The three MG sets feed through two metal enclosed charging control cubicles. Each MG set consists of one 25-kw diverter pole generator (140 volts, 1750 rpm) and 40-hp induction motor (480 volts, 3-phase, 1750 rpm).



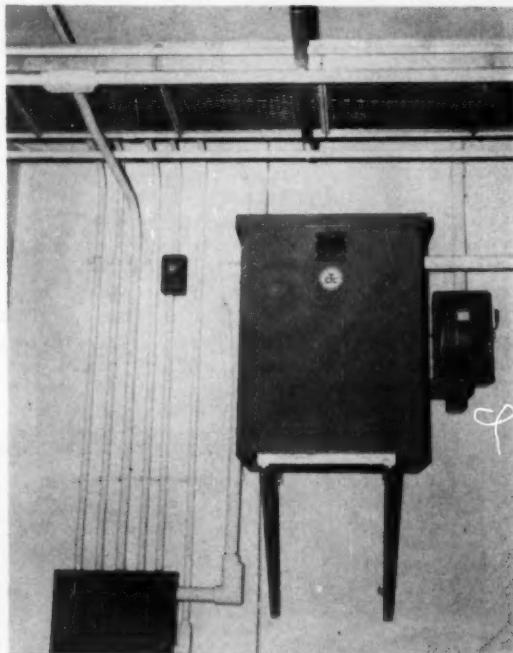
YARD EQUIPMENT includes a range of utilization devices and available facilities. Here, a typical weatherproof lighting fixture and a switched receptacle are shown mounted on columns which are part of the structural work in the yard.



CONTROL WIRING for the high tension yard is neatly racked on channel framing in terminal cabinets. Accessibility to conduit is provided by removable floor plates (one removed here).

and are each rated at 1000 kva. The secondaries of these transformers are 480-volt line to line, 3-phase with the neutral brought out. Primary disconnects and fuses are in the outdoor substation.

The overall plant general electrical load is divided among the substations. Three subs supply power for cell room ventilation and cell room cranes; one sub supplies power for the filter plant; one feeds the metal service and hold-



LIGHTING TRANSFORMER is wall mounted in breaker room. Unit has 480-volt, 3-phase primary fed from outdoor sub and 120/208-volt 3-phase, 4-wire secondary, feeding lighting circuits through panel at lower left.

ing furnaces; two subs power air compressors and the carbon plant; and one carries the office building, locker room, fence lighting and maintenance shop.

Complete electrical construction was done by Fagan Electric Co.



Electric Heaters

BOOST DRIVE-IN

for contractors; double normal service capacity. In-car units keep Gary, Indiana outdoor movie operating through the winter.

FINAL INSPECTION of electrical facilities is made by (L to R) Robert E. Walton, chief engineer and Merrill J. Sweeney, president, Sweeney Electric Co., Inc., Gary, Indiana, shown in transformer vault serving 1,200-ampere outdoor theatre electrical system.

A NEW wiring market is opening up for the electrical contractor. It is developing with the recent trend toward use of portable, in-car electric heaters to keep outdoor movie theatres open all year round. We, at Sweeney Electric Co., Inc., discovered this after we had completed the electrical installation at the Y & W Theatre Corporation's new Gary, Ind. drive-in facility.

The Y & W management asked our company to deliver a complete package "to design and install the electrical systems required for one of the largest drive-in theatres in the mid-west." Our chief engineer, Robert E. Walton, tackled the normal problems inherent with the usual floodlighting, ramp,

driveway and entrance lighting; service to an elaborate sign layout; projection and concession building wiring and the speaker installation for the 1,066-car theatre. What really whetted the curiosity and appetite of our engineers was the order to "design and install an electrical system for over 500 in-car electric heaters" which could be rented to theatre patrons during the winter months.

Subsequent investigation revealed that a new 500-watt, 208-volt electric space heater had been perfected by Arvin Industries, Inc., of Columbus, Ind., and had been used with notable success by outdoor theatres at Louisville, Ky., and Cincinnati, Ohio. These theatres had been able to operate throughout the winter by renting patrons the heater, which was placed on the car seat or floor after being plugged into a special outlet on the

speaker post. Y & W wanted to experiment with the heaters as its new Gary installation to see if the facility could be operated 12 months of the year in the comparatively colder winter climate of northern Indiana.

The Gary installation proved so successful that, after a full winter of operation, Y & W president Marc J. Wolf is sure that in-car electric heaters are a real boom to the outdoor theatre business. And we are convinced that installing the electrical system required by the heater units is a profitable source of additional volume and extra revenue for the electrical contractor. Our reasoning is based on the following facts.

Electrical Capacity Doubled

The average drive-in theatre electrical service is about 600 amps. With the addition of the 500 car heaters,



PORTABLE HEATERS equipped with long-3-wire grounded cord and plug are rented to patron as he enters drive-in area. He plugs 208-volt, fan-type unit in speaker post during performance, returns unit when leaving.



PATRONS KEEP WARM by placing 500-watt in-car electric heater on floor or seat of car while watching movie. Long, grounded, cord extends through window to speaker post receptacle.

THEATRE WIRING

By Merrill J. Sweeney

President
Sweeney Electric Co., Inc.
Gary, Indiana



HEATER CIRCUITS of No. 8 direct-burial cable are fed into speaker post (supported by concrete block base) with conductors for speakers and indicating lights.

service requirements on this project doubled to 1,200 amps. Primary 2,300-volt, 3-phase service from Northern Indiana Public Service Company lines terminates in a transformer vault in one of the entrance buildings. Here, three 100-kva transformers provide a utilization voltage of 120/208 volts on a 3-phase, 4-wire secondary system.

The secondary feeder from the vault to the concession stand required two 4-in. Korduct underground raceways embedded in concrete with 500 MCM, Neoprene jacketed conductors. These serve all concession stand electrical requirements (ranges, popcorn machines, refrigerated coolers, etc) plus the projection room and heater circuits. A second feeder supplies power for moonlight and interior floods (mounted on 80-ft poles), attraction board and ticket booth lighting, ramp beacons and speaker posts.

When we reached the ramping installation proper, we found that the electric heater system added considerably to our work load. Had only speakers and indicator lights been required for each post, the work of plowing the ramps, installing the cables and post equipment would have taken about 125 labor days. The provision for special heater outlets, involving considerable additional trenching and installation of underground conductors, connections, fusing and grounding, ran the labor days well over 200 for this operation. Because of the additional heater circuit cables, about 50% of the trenching on this project had to be done with a Jeep trencher. Normally, a cable plow (which is much faster) is adequate for most drive-in theatre trenching.

To accommodate the portable 208-volt, in-car, electric heaters, each

speaker post (serving two cars) is equipped with a 3-wire, grounded, duplex receptacle in a metal outlet box. Each outlet is grounded to the 120/208-volt, 4-wire system neutral conductor which is also grounded at the transformer vault and central distribution point. A supplementary driven ground rod at the end of each heater circuit run ties into the system. Individual circuits serving groups of heaters are protected and controlled by 30-amp breakers in a distribution panel at the central distribution point in the concession building and projector room. Heaters, rented to patrons as they enter the theatre, are equipped with long 3-wire rubber cords which are plugged into the outlet. The third wire is the grounding conductor.

From the material standpoint, the story is about the same as that for (Continued on page 118)



PROJECTION ROOM equipment required a 200-ampere 120/208-volt, 3-phase 4-wire feeder; posed several connection problems. Concession stand took same size feeder.

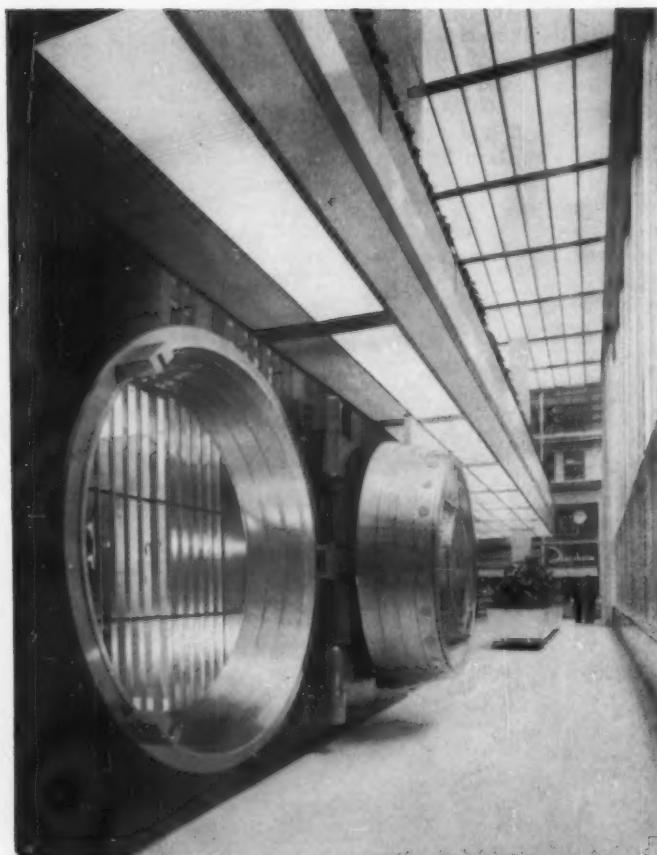


PART OF THE 500 electric heaters are checked for electrical defects by theater staff before storing them for summer. Fan-type, 208-volt units weigh 5 pounds, have all-steel shell and bakelite feet. Heater circuits are controlled from projection booth.

Bank Invests in LIGHT

Manufacturers Trust Company builds smart new glass-walled bank on New York's Fifth Avenue which combines light and architecture in bold new design concept that attracts attention, identifies building, symbolizes and promotes the bank's services and facilities.

By Berlon C. Cooper



VAULT is on first floor, with 30-ton door open to sidewalk view through the all-glass wall. Second floor terminates seven feet behind glass wall, provides high ceiling, and accents open design of bank.

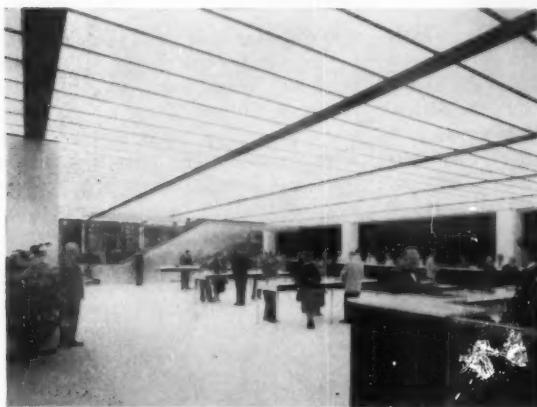
LIIGHT, and a distinctive departure in bank architecture, have been combined to create an unusual and attention-getting new banking structure in mid-town New York City. It is the new Fifth Avenue branch of the Manufacturers Trust Company, recently completed. Its glass-wall construction and luminous plastic ceilings break with traditional fortress-like structures generally associated with financial institutions, and provide a refreshingly new and wide-open view of modern banking at its best.

The new concept in bank design expressed by this new building is no mere accident. The bank's officials had long wanted to bring its operations out into the open, to dispel the usual gloom and apparent secrecy normally associated with bank structures. So they gave free rein to architects Skidmore, Owings & Merrill in carrying out these objectives. The architects, leaders in contemporary design, refused to be inhibited with tradition in bank architecture or design practice. The result is the new and distinctive architectural and structural design concept which has met the full approval of the bank's officials, and captured the attention and interest of thousands of people who pass it daily.

The building itself has six floors, five above street level. It occupies a 12,500 sq. ft. plot, with a 100-foot front on Fifth Avenue and a 125-foot front on 43rd Street. The five top floors are



LIGHT is a major design element in this new five-story glass-walled bank building, with luminous ceilings providing a brilliant background to silhouette floating floors and thin vertical mullions at windows. Lights are kept on day and night.



STREET LEVEL floor is spacious, accommodates special accounts and payroll check customers. Tellers counters are open, flat-top type. Electric stairway leads to main banking room on the second floor.

walled with 13,000 sq. ft. of clear glass, hanging in aluminum mullions supported from a cantilever edge above. This technique, with the $\frac{1}{2}$ -inch thick glass panels supporting no weight, put all steel supporting members of the mullions in tension rather than compression, permits them to be very thin (4 inches), maintain an "all glass" appearance of the facade.

Because of the building's open design it was necessary to adopt a type

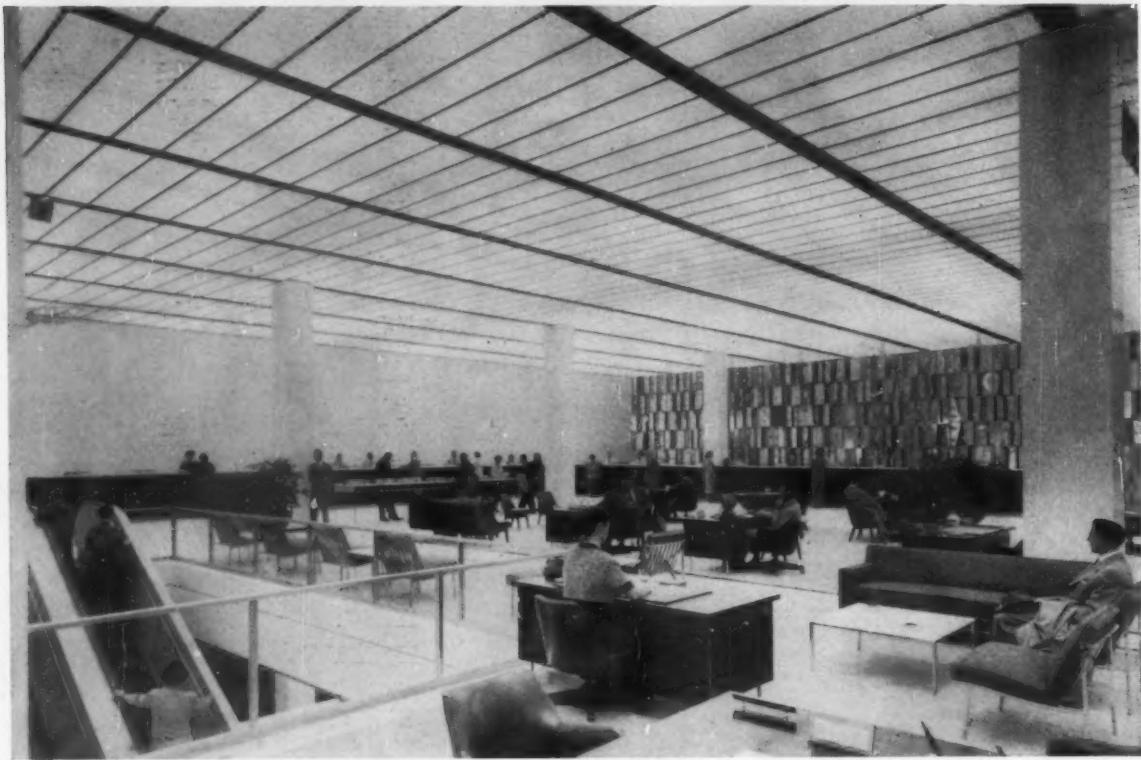
of construction which would eliminate wall columns. Cantilever construction was the solution, extending in two directions from each of the eight interior columns, with steel beams being used in one direction and reinforced concrete slab and joist construction in the other. This combination made it possible to keep floor depth to a minimum.

Light plays a major role in this entirely new architectural concept. Through the use of the uniform bright-



RECESSED TROFFERS with glass diffusing lenses light employees' lounge and recreation area, which is decorated in gay, sunlight colors. Diffuser outlets for air conditioning are integrated with troffers.

ness of translighted plastic ceilings as an interior background to vision through the glass walls, horizontal floors and the thin aluminum vertical mullions are seen in silhouette by night, and by the combination of changing exterior daylight and silhouette during the day. The effect is exciting and dramatic, provides tangible assets of location and identification of the building, and what the bank describes as "a showcase for service".



MAIN BANKING ROOM has wide-open look, accented by luminous ceiling and 120 feet of open tellers counters. Sculptured metal bronze screen at rear (right) is a six-ton 70-foot long decorative highlight, made from 800 large metal panels.

The design and construction of this building required the skilled professional craftsmanship of many artisans and trades—from the architects, designers, and artists to the builders, mechanical and electrical engineers and various trades craftsmen. The lighting and electrical work was done by the electrical contracting firm of Fischbach & Moore, Inc.

The luminous ceiling is time-switch

controlled, is kept lighted from early morning until midnight, seven days a week, and has provision for addition of dimmer equipment should it be desired at a later date. Thus light serves as a subtle advertising medium constantly to bring this bank to the attention of the thousands of people who see it daily, week in and week out, year round.

The first two floors of the building

and wide areas in an L-shape extending in from the outer glass walls on the third and fourth floors, are lighted by luminous ceilings. These are the areas where the ceiling can be seen normally from the street. The inner areas on the third and fourth floors are lighted by recessed troffers, as are the vault, the employees' lounge and recreation areas on the ground floor. Private offices and the main conference room on the fifth floor are lighted by recessed and shielded reflector-lamp units.

The luminous ceiling lighting consists of plastic diffuser panels supported in an aluminum grid framework above which are cold cathode fluorescent lamps.

The aluminum grid framework has narrow T-bar tracks spaced 22.7 inches on centers parallel to the Fifth Avenue side, with each fifth T-bar centering with the window mullions on the 43rd Street side. It also has continuous rows of 10-inch wide aluminum plates spaced 9 ft. 8.5 in. on centers perpendicular to the Fifth Avenue side. These plates center with the Fifth Avenue glass-wall mullions, and conceal the air conditioning diffuser outlets. They also conceal reflector lamp downlights recessed flush in the plates at varying intervals, which provide additional



OFFICES on fifth (top) floor are provided for visiting officials and customers, are lighted by recessed shielded incandescent downlights.

light for customer check counters and similar areas below. This grid framework coincides in plan with a grid pattern design in the terrazzo floors below. All exposed aluminum surfaces in the ceiling were finished buffed satin aluminum to match exactly aluminum finishes used throughout. The entire grid was custom fabricated at the factory to meet the exacting dimensions and finish requirements.

The diffusing light panels are paper-thin white translucent vinyl plastic and corrugated for added rigidity. These panels were furnished cut to size to fit the grid framework, and shipped to the job in rolls for easy handling. The plastic panels and grid framework were fabricated and supplied by the Marlux Corporation.

Fluorescent lamps are installed on 18-inch centers, 12 inches above the diffuser panels. These lamps are 8 ft. cold cathode type T12, and operated at 240 ma on series circuits of 6,000 and 7,500 volts, depending on the number of lamps used per circuit. There are approximately 3,000 lamps used, and 208 Acme Electric transformers which are remotely located in the plenum area above the diffuser panels. Lampholders are fitted to aluminum channels which were shop prefabricated and supplied wired, ready for installation.

The lamp channel housings, transformers, and all cold cathode lamps were supplied by Cold Cathode Lighting Corporation.

To provide for sound conditioning and maximum lighting efficiency, the entire plenum space, which houses air conditioning ducts and miscellaneous other mechanical services, was coated with a plastic acoustical material and then with a high reflectance white plastic coating.

Lighting intensity provided by the luminous ceiling is approximately 55 footcandles, and is of well diffused and excellent color quality. It mixes well with the flood of daylight entering all floors through the glass walls, and creates an atmosphere of openness and cheerfulness which is most pleasing for customers and employees alike.

Recessed troffers were used to light the general office space on the third and fourth floors. These areas, removed from the all-glass walls sufficiently not to be seen from the street, have acoustical tile ceilings to insure ample sound conditioning where business machines are in use. The troffers are standard 3-lamp units, installed in continuous rows, and interspersed with air conditioning diffusers and Muzak outlets. They are equipped with glass diffusing lenses, were furnished by Frink Corp.



LUMINOUS CEILING consists of aluminum T-bars supported from ceiling slab by steel straps, plastic diffusing panels, cold cathode fluorescent lamps, lampholders and wiring channels, and high voltage transformers which are remotely located in ceiling plenum.



WIREWAY CHANNELS supporting lampholders were prefabricated, delivered to job wired, ready for installation. Lamps are 8-foot T12 cold cathode type, series operated on 7500-volt circuits at 240 ma.

The fifth floor houses executive offices and a directors' room, lounge, dining room and small kitchen. These areas are lighted with recessed incandescent reflector units of various types—some louvered, some with Fresnel lenses, some baffle shielded. They were supplied by Lightolier, Inc., and by Century Lighting, Inc.

The electric stairway between the first and second floors is effectively lighted by cold cathode lamps recessed in the stairway balustrades, which diffuse light out onto the treads through perforated aluminum backed up by diffusing plastic panels.

The spectacular metal panel screen in the main banking room, which divides the main banking area from public space in front of the elevators at the rear of the building, is highlighted by reflector spot and flood lamps concealed in the ceiling above the aluminum ceiling plates.

Another sculptured metal decoration

is suspended from the luminous ceiling on the second floor where it can be seen easily from the street or by those in the main banking room. It is spot-lighted by four 2000-watt Century Lighting optical accent lights concealed above one of the aluminum ceiling plates. These spotlights direct a concentrated light beam directly downward, which is intercepted by a polished metal mirrored plate that redirects the light to the hanging metal decoration, or free form. This light gives sparkle to the hanging piece, and also casts an unusual and moving shadow on the plain wall of the interior behind it.

The giant vault with its 30-ton door is located about ten feet inside the Fifth Avenue glass wall, in plain view of all passersby. To accent this first floor architectural feature, floodlights have been recessed in the low wall below the glass wall directly in front of the vault.

How to Boost Estimating Output

Application of four basic principles of industrial production reveals new ways to improve estimating efficiency

By Craig T. Naudain
C-T-N Estimating Associates, Ridgewood, N. J.

EVERY electrical contractor maintains a continuing search for any new tool or technique that will improve the work output of his mechanics. His reasoning is as sound as it is obvious: increased output per man-hour cuts costs, builds volume and brings greater profits. Few contractors realize, however, that these same benefits can be obtained by bringing the estimating department up to optimum effectiveness.

The efficiency of the estimating operation can be judged by the accuracy and the volume of the work bid. Accuracy is governed almost entirely by the ability and the training of the estimating staff and by the quality of the data—job details, labor units, material costs—which are available to them. The matter of bidding volume, on the other hand, is largely determined by effectual management.

Whether the estimating of your firm is handled by ten men or the part-time services of one man, proper administration of the estimating department can bring tangible rewards in the form of added contract volume or more free time for other work.

The electrical contractor's estimating department may be compared to a production line. It is supplied with raw materials in the form of plans and specifications. These are put through a series of processes—the take-off, pricing and summation—and an end product—the bid—is assembled.

Using this analogy, we may profit-

ably apply to the estimating operation four basic precepts of production management:

1. Employ personnel at their highest level of skill.
2. Select products having low cost in relation to marketability.
3. Simplify the process wherever possible.
4. Develop flexibility of production facilities to meet fluctuations in sales activity.

Control of Personnel

Technically skilled personnel cannot economically perform routine chores. They may do the work better, but the cost is excessive and the loss of the technician's time from his own work will cut production.

The estimator is usually the most skilled and one of the highest paid employees in the electrical contractor's organization. His time must be carefully managed to obtain maximum benefit of his skills. Effort should be made to relieve him of all non-essential routines and, further, to spare him from the non-technical elements of the estimating process.

The extension of labor and material units and totaling the individual sheets, for example, involve nothing more than simple multiplication and addition. These can be assigned to a reliable clerical worker.

This has a double advantage. It frees the estimator for more detailed work. Secondly, it tends to increase

the accuracy of the bid, since he will check a clerk's arithmetic in detail while he is likely to make only a superficial check of his own work.

Taking off the conduit, wire, outlet boxes and fixtures for the circuit wiring and auxiliary electrical systems can usually be delegated to a junior estimator, freeing the estimator in charge for harder parts of the job.

One more control measure is necessary to assure most efficient employment of the estimating staff: minimize idle time between bids. The contractor must check regularly with the chief estimator to make sure that a full schedule is being maintained. A tentative work plan of the type shown in Fig. 1 will quickly show up any blank spots in the agenda. It will also help in keeping a sound balance as to types and sizes of work being sought.

The amount of direct regulation which the contractor must exercise over the estimating department will vary according to the degree of responsibility shown by the head of the staff; but in every case the executive must closely coordinate the work of this department—the keystone of his sales operations—with the rest of his organization.

Job Selection

In selecting an article to produce, the manufacturer is faced with two prime considerations: marketability and cost of production. He must be certain that the sales potential of the product will

JANUARY ESTIMATING SCHEDULE																						
WORK DAYS →		3	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28	31
* — Research & Inciditals																						
✓	✓	✓	*	✓	✓	✓	✓	✓	✓	✓	✓	✓	*	✓	✓	✓	✓	✓	✓	✓	✓	
PROJECT	DESCRIPTION	APPROXIMATE COST	APPROXIMATE ESTIMATING TIME	PREPARE BID ON —	PLANS AVAILABLE	NOTES	BID DUE															
Loew Grade School	1-Story — 10 Classrooms	\$35,000	3 Days	Jan. 3, 4, 5	Dec. 28		Jan. 7															
A.C.T. Plastic Co.	Rewire — 24,000 sq. ft.	\$60,000	4 Days + Field Trip	7, 10, 11, 12, 13	Dec. 30	Meet owner — Jan. 7	Jan. 17															
Guard Oil Co.	Service Station	\$10,000	1 Day	14	Jan. 11		Jan. 17															
Newton Sewage Plant	200-hp Pump System	\$15,000	1½ Days + Field Trip	17, 18	Week of 10th	Inspect Job site Jan. 17 — A.M.	Jan. 21															
Jones Mfg. Co.	New Service & Dist—400 kva	\$75,-90,000	6 Days + Field Trip	25 Thru 31 See Feb. Sched.	Jan. 24	Inspect Job site Jan. 25 & 26	(?)															

FIG. 1. TENTATIVE ESTIMATING SCHEDULE assures minimum of idle time between bids. Work days are listed at the top of the chart and checked off as assignments are made. Unchecked dates (Jan. 20, 21, 24) are open and must be filled by obtaining another job to figure. Note that at least two days are left free for catching up on details and for research.

justify the necessary commitment of capital.

As applied to contractor's estimating operation, the first of these factors, sales potential, is interpreted to mean that each job being considered for bidding must be appraised in terms of the apparent chances of winning the contract.

For example, on a project where ten general contractors are listed as bidders, there will probably be at least twice that many electrical firms after the job. The odds against any one outfit would then appear to be 20 to 1. But in market areas where bid-shopping is common practice, there is small chance of anyone getting this contract at a fair price.

There is of course no worthwhile formula for determining when to bid. Each prospective job must be weighed against the general availability of work and the cost of preparing the bid.

It must also be pointed out that the cost of bidding—figured in terms of the estimator's time per thousand dollars of bid price—will vary according to the nature of the job.

Among the factors affecting estimating costs, the size of the job is the most important, since it is a consideration applying to every job. As is the case with the manufacturer, the *unit cost decreases as the volume becomes larger*. The approximate relationship of cost vs. job size is given in Fig. 2, which is based on a \$150 per week estimator working without help.

The reasons for this effect are apparent: larger jobs include greater quantities of the same basic items—conduit, wire, boxes, fixtures—and very often these are arranged in simple, repeated patterns which are easy to take off rapidly.

Feeder runs provide a good example of the first condition in that there is no great time difference between estimating a 50-ft run of 1-in. conduit and a 200-ft run of 2-in., while the dollar

volume of the latter is several times larger.

Repeated circuit patterns reduce estimating time, too. In a typical school, most classrooms are wired identically. Therefore, if it takes five minutes to take-off one classroom, six, ten, or twenty similar rooms may be covered in almost the same time. This is also true of large industrial plants and warehouses.

The nature of the work may influ-

SIZE OF JOB AFFECTS COST OF BID PREPARATION AND ESTIMATING CAPACITY		
Bid Price in Thousands	Cost of Estimating*	Weekly Estimating Output in Thousands
\$5 to \$10	\$30.	\$25 to \$50
\$10 to \$25	\$45.	\$33 to \$83
\$25 to \$50	\$2.50 per M	\$60
\$50 to \$100	\$2.00 per M	\$75
\$100 to \$200	\$1.75 per M	\$86
over \$200	\$1.50 to \$1.25 per M	\$100 to \$120

*Based on work rate of a skilled estimator paid at \$150. per week.

FIG. 2. LARGER CONSTRUCTION JOBS include greater quantities of basic materials in easily taken off patterns, also expensive equipment (transformers, load-centers) so that estimator's output grows with the size of the job. Special work such as modernization, underground or pole line installations usually require more time to figure.

ence the estimating cost. Modernization work and jobs involving extensive underground work, for example, usually require time-consuming field trips. Hazardous location installations often demand hours of work for selection of special equipment and fittings and devising hanging methods.

Jobs of these types are certainly desirable but they must be engineered in detail before they can be figured. If the plans and specifications are vague and incomplete, this design task falls to the estimator. In such a case, the contractor should be certain that his chances of being awarded the contract are strong enough to justify a disproportionately large investment in estimating and engineering.

This principle should also be applied to regular construction jobs. Too many contractors fail to realize that bidding on the basis of sketchy plans and specifications is a double violation of sound business practice: first, they are giving away an engineering service; second, they are chasing a rainbow since jobs like this invariably fall to the bidder who figures on sub-standard work.

Few electrical contractors have a completely free choice of jobs they can bid. Limited capital, insufficient prestige, or the absence of an established relationship with architect or owner may put a particular job beyond reach. But in today's vigorous construction market, most firms have a wide range of work open to them. By using discretion in selecting the work to be bid, the estimating output and, it follows, the amount of contract work can be substantially increased.

Cost Control

Manufacturers continually strive to simplify each operation of the production process and to eliminate non-essentials. Even a small reduction in unit cost can achieve a substantial savings when applied to the total quantity of work output.

The contractor also has the opportunity to cut bidding unit costs by simplifying his estimating procedure.

Such items as the service equipment and distribution do not rapidly lend themselves shortcut methods of take-off. Each component represents a significant amount of labor and material which must be studied closely and listed in detail. The branch circuit wiring, however, is composed of large quantities of relatively low-cost items which are practically identical in quantity ratios for ordinary construction jobs.

We know that branch circuit conduit averages about 15 feet per outlet; also

BRANCH CIRCUIT CONDUIT AND FITTINGS					
ITEM	SIZE	QUANTITY	*COST PER EXTENSION		
Galv. Conduit (Heavywall)	1/2 in.	15,000 ft.	\$12.56 C	\$1884.00	
	3/4 in.	9,000 ft.	\$16.13 C	\$1451.70	
	1 in.	4,500 ft.	\$22.63 C	\$1018.35	
Cost of Conduit				\$4354.05	
Locknuts and Bushings	1/2 in.	2,000 ea.	\$43.50 M	\$87.00	
(2 per each 15 ft of					
conduit)	3/4 in.	1,200 ea.	\$62.50 M	\$75.00	
	1 in.	600 ea.	\$102.50 M	\$61.50	
Cost of Terminals				\$223.50	
Straps, Screws and					
Lead Shields	1/2 in.	2,000 ea.	\$9.95 C	\$199.00	
	3/4 in.	1,200 ea.	\$11.45 C	\$137.40	
(1 per each 7 1/2 ft of					
conduit)	1 in.	600 ea.	\$13.95 C	\$83.70	
Cost of Supports				\$420.10	
Total Cost				\$4997.65	

* Based on National Pricing Service listings.

QUICK METHOD

Cost of Conduit (per above listing)	\$4354.05
Cost of Terminals	—add 5%.....	\$ 217.70
Cost of Supports	—add 10%.....	\$ 435.41
Total Cost	\$5007.16

Error = \$9.51 or .2%

FIG. 3. QUICK METHOD of estimating terminals and conduit hangers saves time expended for take-off and pricing. Similar techniques can be used to speed the estimate by deriving the quantity of boxes from the number of wiring devices and fixture hangers and lamps from fixtures.

that there are two terminals per outlet. Therefore required number for each size of locknuts and bushings is obtained by dividing conduit by 7 1/2. Conduit hangers are similarly determined by dividing conduit by the specified spacing between supports.

Fig. 3 shows a typical listing of branch circuit conduits, terminals and hangers. It will be noted that by adding 5% and 10% to the conduit price, the cost of terminals and supports is covered. The small error of \$9.51 amounts to about two-tenths of one percent, hardly a significant amount in a job like this which apparently involves about 1900 outlets. Labor charges are included as usual in the conduit and box units.

Contractors who work regularly with certain types of installations—schools, apartment houses, or office

buildings—have developed standard wire-to-conduit ratios. They take off all the circuit conduits and multiply the total length by a figure between 2.3 and 3.5 (see Fig. 4) to obtain the amount of wire. Serious errors may occur, however, if this method is not used with extreme care.

Circuit wire and conduit can be taken off without repetition of measuring and listing by the method illustrated in Fig. 4. In a like manner the number and type of outlet boxes may be easily derived from the take-off of fixtures and wiring devices.

At least half of the errors made in bidding are simple mistakes in multiplication and addition, so the importance of closely checking this work cannot be overemphasized. But this does not mean that each extension of material and labor units need be repeated

CIRCUIT WIRING TAKE-OFF FOR TYPICAL COMMERCIAL INTERIOR														
	1/2" C.		3/4" C.		1" C.									
	2w	3w	4w	5w	6w	7w	8w							
PANEL A	984	526	142	—	182	42	27							
PANEL B	1363	649	412	48	95	—	—							
PANEL C	1071	729	267	70	—	—	—							
PANEL D	1139	784	212	40	32	—	—							
CONDUIT	4557	2688	1033	158	309	42	27							
	X 2	X 3	X 4	X 5	X 6	X 7	X 8							
WIRE	9114	8064	4132	790	1854	294	216							
	1/2" C.		3/4" C.		1" C.									
	4557		1033		309									
	2688		158		42									
	<u>7245</u>		<u>1191</u>		<u>27</u>									
5% waste	362		60		19									
Totals	<u>7607</u>		<u>1251</u>		<u>397</u>									
Total Conduit = 9255 ft.														
Total #12 wire = 26,800 ft. (including 10% waste)														
Wire/Conduit Ratio = 2.88														
TYPICAL WIRE/CONDUIT RATIOS														
Schools	— 2.80 to 3.30													
Warehouses	— 2.65 to 3.10													
Hospitals	— 2.50 to 2.80													
Apartments	— 2.30 to 2.70													

FIG. 4. COMBINED TAKE-OFF of wire and conduit eliminates repetitive work. An even simpler method is possible where definite wire/conduit ratios have been established. Simply measure off the total branch circuit conduit and multiply by the wire/conduit ratio to obtain total wire.

in its entirety. Sufficient accuracy is assured by multiplying two significant figures. Thus, an item such as:

427 units @ \$14.19 per c = \$60.59 would be quickly checked as:

$$430 \times \$14.00 = \$60.20$$

This is close enough to indicate that no error of importance has occurred.

An important by-product of the estimate is the Bill of Material. When the contract has been awarded, this inventory of required material should be available from the estimate with minimum of effort. Conduit, boxes, fittings and wire occur on several sheets of the estimate; but the transfer may be expedited if the estimate lists these items in a standard sequence at the top of each page. There may be a possibility of overlooking some item which has been combined into another listing such as the previously men-

tioned conduit terminals. This can be avoided by including some notation on the estimate listing such as "(inc. L&B)"—includes locknuts and bushings.

Other shortcuts will be discovered if the estimator will adopt the attitude of the industrial engineer. Before starting work on a project, he must examine the characteristics of the job in detail to see if any steps in the process can be simplified; and during the work operation he must be continually on the lookout for any device which might help on the next undertaking.

Variable Output

Manufacturers dealing in a fluctuating market must make provisions for meeting temporary surges in demand.

The electrical contractor is in a

similar position with respect to his estimating staff. Periodically, he will receive at one time several bid requests from regular clients which he is obliged to satisfy. Possible solutions are overtime or temporary assignment of an engineer or field superintendent to estimating. These stopgap measures may not meet the emergency, however, in which case the contractor may be tempted to submit a token bid. A better course is to call upon an *outside* estimator.

Many contractors have had bitter experiences with estimating services. But the fact is that a reliable service—and such exist—can be a tremendous help, even to the extent of taking over all the contractor's estimating.

Dealing with an estimating service must be handled carefully. The contractor must first be assured of the competence of the agency. He must also be certain that all special details of each project are conveyed to the outside estimator so there can be no misunderstandings in the preparation of the bid.

Responsible estimating services are glad to furnish references as to their integrity and ability. But very often their most satisfied clients are unwilling to supply a recommendation; apparently some contractors feel that use of such a service reflects unfavorably upon their professional ability. Sample estimates of previous jobs afford the best means of evaluating the estimator's skill. The first few jobs must also be checked closely in order to establish confidence and mutual understanding.

Estimating consultants, however expert they may be, are limited in their accuracy by the amount of information they have to work with. They must therefore be acquainted with every aspect of the job. Such details as the job location; general quality of labor; work which will be sublet such as pole lines; in fact all of the many considerations which affect job cost must be passed along to the service estimator. He should be permitted to call the architect, the consulting engineer and the electrical wholesalers as a representative of the contractor, for that is his actual role.

All of the techniques which have been described here may not be applicable to your particular estimating operation, but use of any of them can achieve appreciable returns in increased bidding volume. Many other ways to expedite bid preparation will be found by the contractor who adopts the attitude of the industrial engineer—that every process can be improved.

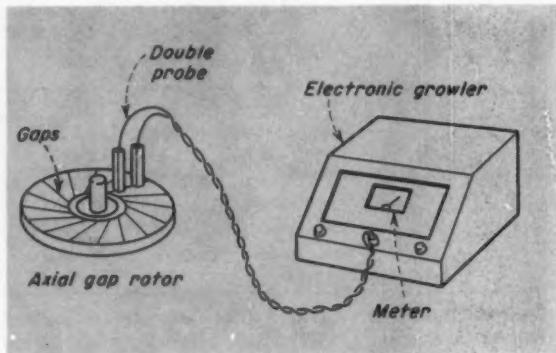
AT THE TEST BENCH-8



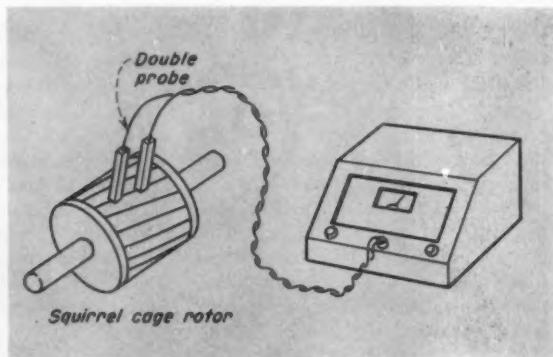
THE COMPLETE SET of equipment for electronic growling consists of: (l. to r.) an accessory unit for testing air core coils, four different probes (spread out on bench), and the main electronic growler unit.

AC Motor Testing with An Electronic Growler

By **Walter J. Prise**, Chief Engineer, Queens Electric Motors, Inc., Jamaica, N. Y.



TEST 1. Testing a copper spun rotor of axial air-gap type motor. Here, a double probe, emitter in one probe and receiver in the other, is used for the test. The two elements of the probe may be moved independently. With the double probe, the skew of the slot can be followed. A rotor bar is a closed circuit and will show a constant basic deflection on every sound slot. An open bar or partially open end ring will reduce the deflection of the meter pointer to approximately zero. Presence of some other irregularities will be indicated by deflection lower than the basic indication.



TEST 2. Testing a squirrel-cage rotor of conventional type. Here, again, the double probe is used to make the test. The double probe, with the emitter in one probe and the receiver in the other, provides greater convenience in locating the fault. The two sections of the probe can easily span one bar. Because the slots are skewed, a single probe could not lie flat along the slot.

AN ELECTRONIC growler is an instrument used for detecting and isolating faults in rotating electrical machines. It can be used to show up shorts in windings and to ground, wire breakage, improper terminal connections and defects in bars and end rings of squirrel-cage rotors. Tests can be made on distributed windings, field coils and squirrel-cage rotors.

The basic electronic growler unit consists of a power supply, a vacuum-tube oscillator, an amplifier, a regulator and rectifier circuit and an indicating meter on the front panel of the portable housing. A set of interchangeable probes is used with the unit and provides testing of different sizes of machines. Rod-like single probes are used to test distributed windings; field coils are tested with double probes. Four different probes, ranging in width from 0.25 inch to 1.5 inches, permit testing of any size of motor from fractional to several hun-

dred horsepower. Use of the different probes depends upon slot width on the part under test. The larger probes are more sensitive than the smaller ones. An important rule to follow in using the probes is that the test probe should not span more than one slot. This is necessary to permit detection of individual faulty coils. Each probe consists of an emitter element and a receiver element. The two elements are in a single housing in single probes and in separate housings in double probe.

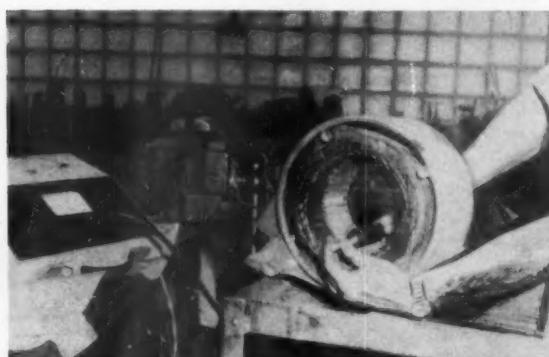
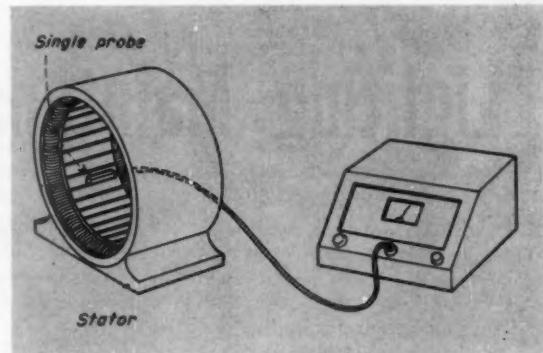
Generally, the theory of operation of an electronic growler is similar to that of the ordinary growler found in any shop. The difference between the two types is the frequency of the magnetic field set up. The electronic growler is a high (800 cps) frequency unit. This use of higher frequency offers greatly increased sensitivity and, as a result, broader scope of application. The electronic growler is sensitive enough to register a distinct meter deflection for

even a single shorted turn in a coil.

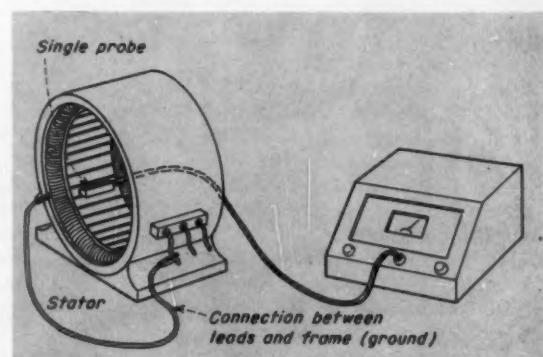
The electronic growler operates on an induction principle. Electrical energy is fed from an electronic vacuum tube oscillator circuit to a test probe around which an alternating magnetic field is set up. This field oscillates at a frequency of 800 cycles per second. When the single probe is placed upon the slots of a wound stator or rotor, the magnetic field generated by the probe permeates the winding and induces a voltage in the conductors. In a good winding, there is no closed circuit in the winding, and current will not flow as a result of the induced voltage. If, however, a faulty winding (for instance a short circuit between turns or phases) is present, a closed circuit exists and induction current can flow. The induced current flowing in the case of a faulty winding is reflected back through the probe to the instrument where it is amplified and registered on the meter.



TEST 3. Making a ground test on the stator of a 3-phase motor. In this test, a single probe is better suited to the job. In the single probe, the emitter and receiver elements are in the one probe head. The probe is held so it runs along and spans one slot on the rotor. A connection is then made between the motor frame (ground) and each of the motor leads in turn. The probe is located on any slot on the stator and kept in the one position for the entire test. Presence of a ground on any one of the phases will be indicated by deflection of the meter pointer.



TEST 4. Testing a stator for faults in the windings. The single probe is used and placed on the slot as shown. Zero deflection of the meter pointer will indicate normal condition. Marked deviation from this set pattern will appear when the probe is placed over the slot of a shorted coil. In a delta-connected stator, some constant basic deflection will indicate normal condition. Fault is indicated by increase in deflection when probe is placed over shorted coil.





WASH-RINSE TANK, fabricated from aluminum, is easily handled by 2-man team. With hinged drain board folded flat, the castored unit is compact and mobile. Piping connections provide convenient means for filling and draining tank.



SPECIAL BRUSH ASSEMBLY utilizes square brushes fabricated from nylon bristles, both of these factors being dictated from experience. Inclined drain board, supported by hinged legs, provides place to stack louvers as they are washed.

Lighting Maintenance By Contract

IN SEVERAL ways the owner of a lighting installation is like the owner of a car. Both have invested money to obtain desired services. Both have given thought to performance and style, and have considered comfort and efficiency. Yet all too often the analogy ends at that point, for car owners automatically consider *maintenance* as a necessary and desirable operating expense, whereas the owner of a lighting installation usually has to be sold—and sold hard—on this essential. Such has been the experience of the lighting maintenance division of the T. L. Rosenberg Company in Oakland, Calif. (the new president of which is Leon Hampton of Longview, Wash.)

No motorist would argue against the logic of frequently checking tires, batteries, spark plugs, oil filters and such, for he knows that the condition of these items plays an important part in obtaining the fullest return on his investment. Yet little thought is given to the fact that lighting installations, as well, can depreciate because of defective ballasts and starters, loose or broken sockets, burned out lamps, broken switches or grounded wires, low voltage or dirty fixtures.

This oversight or ignorance—call it

what you will—pushes operating costs up, drives efficiency and profits down, for it is now general knowledge that employees work better when they see better, that sales and accuracy are proportional to illumination levels, and that wasted lumens cost just as much per kilowatt-hour as useful light.

Promoting the importance of maintenance, therefore, becomes a contractor's duty to his customers but, above that, it affords an opportunity to enter a new field of service and profit. Maintenance promotion requires plenty of leg work, repeated calls, constant education and the expending of time, energy, thought and tact. Yet results can be highly gratifying, as evidenced by the Rosenberg company's operation of four service centers (Oakland, San Francisco, Fresno and Marysville) from which they serve over 300 contracts and cover more than 50,000 lamps.

Since they started their lighting maintenance department in 1947 they have developed, adopted or adapted numerous methods and items of equipment contributing to efficiency. And, in all contacts, the company has striven to consider *customer* interests and *customer* conveniences, impress-

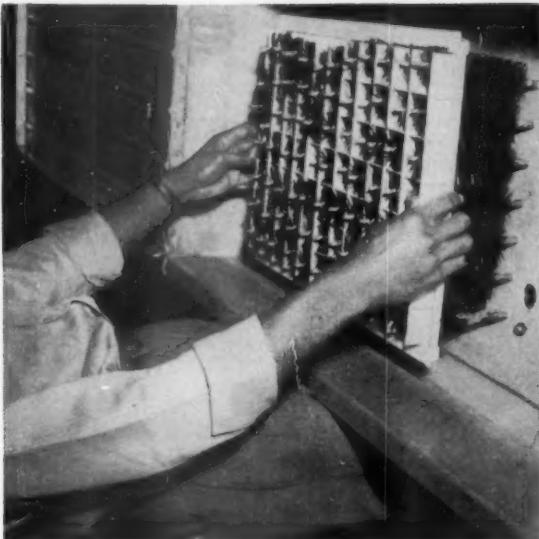
ing them at the same time with high quality service, courtesy, friendliness, neatness, efficiency, care, speed and progressiveness. Every available opportunity is taken to continue the lighting education of customers already under contract, for it is realized that contracts will remain in effect only so long as customers believe that contract rates are less than their potential losses in wasted capital investment, wasted operating charges for electricity, wasted manhours due to their own unscientific approach to cleaning or replacement of parts, or wasted output due to decreased employee accuracy, speed or morale.

Physical Requirements for Service

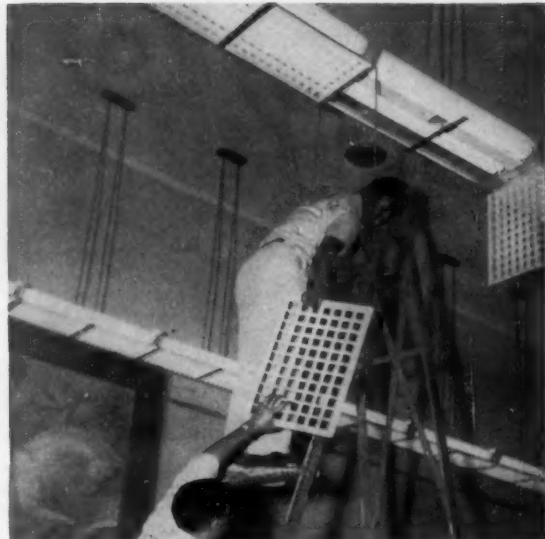
Equipment and materials required by a lighting maintenance company can be classified under several categories of purpose; such as those required for transportation, cleaning, replacements, repairs and selling.

For example, to transport equipment, each one of these four offices has at least one panel delivery truck and, in addition, the company has one elevation-ladder truck and several open stake-body vehicles.

Each panel truck is amply stocked



LOUVERED SHIELDS are raised and lowered over square brushes during cleaning cycle. Special detergent loosens grime quickly and speeds non-streak drying. Wash tank, shown here, was drained to more clearly show details.



TWO-MAN TEAM is employed to service each installation since this procedure was found to reduce time and effort, also promote efficiency and safety. Freshly-laundered smartly-tailored shirts carry name and trade-mark of company.

with the normally-used varieties of lamps, ballasts, starters, sockets, and wiring accessories. Since, however, the men know ahead of time the characteristics of the jobs scheduled for each day's assignment, they can check their truck inventories before leaving the shops each morning, and can draw extra items from office-located stock rooms if unusually large demands for particular items are anticipated. These trucks also carry an assortment of ladders (aluminum up to 10 feet; both A-frame and extension types for greater heights) and, when servicing

several specific installations, they also transport sectional scaffolding. The trucks are likewise used to carry wash-rinse tanks to the job-sites, pails and sponges, rubber connecting hoses for filling and draining tanks, detergents and rags, drop cloths for covering customers' furniture, meters for checking and testing purposes, time sheets and work forms for records and receipts. The panel trucks are dispatched to most of the commercial installations, and the ladder truck is used to facilitate relamping and cleaning of luminaires along parapet walls or over high

doors, pole-mounted fixtures above gasoline service stations or—where industrial plants have wide aisles, high bays and truck entrance doors—interior fixtures in otherwise hard-to-reach locations. When so used, the truck and ladder form a movable platform arrangement which is safe, convenient and fast.

The fact should not be overlooked that a well-stocked truck, frequently washed and manned by neat, courteous men, is also an effective advertising medium. For that reason the company name is displayed prominently on all



ELEVATION LADDER on rear of truck facilitates cleaning and relamping of luminaires over doorways, mounted on poles, along parapet walls or in high-bay wide-aisle industrial plants. Crows-nest provides safe, comfortable working platform.



PANEL TRUCK, kept washed and polished, carries company name, address, telephone number and distinguishing trademark on sides and rear as an effective advertisement. Assortment of aluminum and wooden ladders are carried on roof rack.



LAMPS AND WIRING COMPONENTS in adequate supply are carried in bins, racks and special compartments inside each truck. Extra quantities of items can be shifted as needed from central office-located stockrooms to these vehicles.



BALLASTS, STARTERS, SOCKETS, switches, wire and other accessories are carried in stock in addition to lamps covering great variety of lengths, diameters, colors and operating characteristics. Inventory is replenished frequently.

side and rear panels, together with the address, phone number and trade-mark—in this case an eye-catching reproduction of a glowing fluorescent lamp.

Another opportunity for advertising is related to the uniforms of the men, for each one wears a frequently-laundered smartly-tailored shirt with "Rosenberg" and, again, a glowing fluorescent tube across the back. As a serious pun, one might comment that "a company's good name is carried on the shoulders of its men".

Special Tanks Speed Washing

As in many other fields of endeavor, most of the methods and items of equipment used represent numerous trials and revisions. For example, the wash-rinse tanks which are employed are divided down the centers to form twin compartments. These tanks have hinged, grooved drain boards to support louvered shields, have connections for filling and draining the tanks, have rubber castors for quiet and easy movement, and they have shelves beneath the tanks to hold detergents, rags, sponges and the like.

They also are fitted with removable metal trays which may be placed inside the washing compartments. These trays contain 77 brushes each, arranged in seven rows of 11, with brushes on 2-in. centers in both directions (the dimensions of standard 2-by-2-in. louvers). These brushes are square in cross section, since it was found from experience that square brushes have greater and more even contact with the flanks of each louver cell than standard round ones. And the brushes are also made of nylon since,

again from experience, it was found that nylon bristles have greater resilience, have longer life, dry faster and are less likely to scratch than bristles made from other fibers.

Since most of the louvered fixtures serviced have 2-by-2 in. cells, the cleaning cycle is speeded by pressing the louvered shields downwards over the brush trays in the detergent-saturated wash water, then sloshing them up and down a few times in clean rinse water, then allowing them to drain on the inclined drainage board.

Experience dictated still a third change in the initial approach to cleaning, for initial practice employed such things as infrared lamps, Calrod heaters and blowers to speed the drying cycle but, more recently, it was found that these items became redundant when modern non-streak fast-drying detergents came upon the market. The time required for this single wash-rinse-dry cycle (*not* so incidentally) is now only 40% of what it was originally, and it illustrates forcefully the fact that service can be improved, contract rates can be reduced and profits can be materially increased through ingenuity, analysis and constant, progressive revision of methods.

Schedules and Team Work are Essential

Even on small jobs, it was discovered that a 2-man team is more efficient and economical than a single worker, for it speeds the set-up of equipment; divides the weight of manually-moved tanks, ladders and other bulky or heavy equipment that has to be carried, and greatly cuts down the amount of walking or climbing. General routine is to

transport these teams to various jobs in one of the company's trucks—the driver of the truck also serving as the foreman or job supervisor. Then, while the foreman contacts the owner or manager of the premises for public-relations and routine business reasons, the 2-man team unloads the equipment, sets it in place, fills the tanks with hot water, covers objects beneath the fixtures with drop cloths and erects necessary ladders or scaffolding.

The foreman also takes several general area light-meter readings, noting them on a work card and indicating them to the owner. He then leaves the premises and, while his crew proceeds with the cleaning of fixtures and replacement of blackened lamps, he generally makes personal calls on other owners in the neighborhood, thereby contributing to a constant public-education program and also promoting other contracts in the immediate vicinity. This door-to-door personal contacting of owners is a most effective means of obtaining new customers, although the value of direct mail, phone calls, other types of advertising and word-of-mouth testimonials should not be minimized.

Returning to the lighting installation being serviced, the foreman finally makes necessary repairs or replacement of parts, takes a second set of light-meter readings for the information of the owner, also company records, leaves a duplicate notation of meter readings, working hours, etc., with the owner, then drives his crew to the next maintenance location where the entire procedure is repeated.

Workers are instructed to be neat



ATTRACTIVE ENTRANCE to Oakland office (one of four main-tenance centers in central California) welcomes customers to offices, drafting room, shop, warehouse and garage. Four offices collectively serve 400-mile-long territory.

and courteous at all times, leave customers' premises as clean or cleaner than when first visited, replace all moved furniture to its exact original position, and wipe up all traces of dust or water before departing. The foremen are also instructed to phone their offices every hour so that, if emergency service is desired by other customers in the same area, it can be given with minimum delay. This procedure, plus the fact that some of the employees are on 24-hour call (holidays and weekends included), means that emergency service, such as the replacement of a flickering lamp or noisy ballast, can generally be rendered within an hour to two after the initial call is received.

Terms of a Typical Contract

All of the Rosenberg contracts are for 1-year duration, the renewal becoming automatic unless one of the two parties terminates it in writing at least 30 days prior to the expiration of any year-long period. In these contracts the company agrees to render maintenance service for specified numbers and types of fixtures, listing such pertinent data as locations and mounting heights of luminaires, wattage and color of lamps. The contracts also specify the frequency and dates for cleaning and checking, and indicate whether or not such items as tubes, starters, ballasts and lampholders are included in the flat monthly fee or are to be billed as extras.

In this connection, the usual procedure is to initially check the customer's voltage at socket points, replace all humming ballasts, replace burned-out or blackened lamps, and

place the system in general good condition *before* the contract begins. This service is billed separately. Any subsequent repairs or replacements are included as part of the contract, and are accepted by the company as legitimate "calculated risks".

For this maintenance service, each customer agrees to permit access to his premises and fixtures at specified times (such as 8:00 a.m. to noon, 1:00 p.m. to 5:00 p.m. or 6:00 p.m. to 2:00 a.m.). He also agrees to notify the contractor promptly if fixtures start to function improperly; to forbid all unauthorized persons from tampering with or otherwise supposedly "maintaining" the fixtures; to absolve the contractor from the effects of government regulations, strikes, fires or accidents beyond the contractor's control and to pay a fixed fee monthly, in advance, to the local offices.

Contract rates vary widely, determined from experience and based upon such considerations as type of premises (bank, factory, school, office, etc.), height of fixtures, type of luminaire, availability of water connections, parking problems in the neighborhood, travel time from the central office, age of the installation, floor obstructions, variations in mounting details, amount of glass involved (panels), hours decided upon for servicing (night or day), rapidity of dirt accumulation, interference with workers by customer's employees (or vice versa) and many other factors learned during years of "apprenticeship" in this field.

On large jobs, where uniformity of brightness or color is important, where mounting heights are high, where

lamps are otherwise hard to reach, or where interruptions are to be kept to a minimum, group lamp replacement is strongly recommended. In these cases an attempt is made to teach customers the "facts of light" through lamp-life curves, lumen-output charts, frequency of burn-outs during the latter stages of normal life, and so on. In many instances this educational approach has won customer approval to replace all lamps simultaneously at the 60% to 70% point, with about 10% of the better tubes being saved for interim replacement during the succeeding life cycle. This group replacement plan, however, requires a great deal of salesmanship, for, unfortunately and unaccountably, the average customer still fails to recognize the logic of scrapping lamps before they have flickered or blacked out completely. About nine out of every ten contracts, therefore, are on an individual-replacement basis as lamps burn out.

Public Education is Improving

But, regardless of his hesitance in adopting group-replacement logic, the average customer is becoming convinced that lighting is an important investment in improved appearance, improved employee morale, increased efficiency, fewer errors or rejects, improved workmanship and fewer accidents. He also is becoming increasingly cognizant of the fact that he, as an individual, does not have the technical knowledge, manpower, time, tools or equipment to replace lamps, wash dirty fixtures, test lamp and power characteristics or renew auxiliary components.

Fully realizing the desirability of maintaining high levels of appearance and illumination, yet recognizing the fact that he is not equipped to efficiently or economically obtain these objectives through his own organization, the prospective customer is usually receptive to the suggestion of maintenance by contract. Therein lies the contractors' opportunity and responsibility to provide top-flight service at reasonable charges.

This can be obtained through careful planning to minimize waste labor, maximum use of modern methods and equipment, constant on-the-job field checks to insure customer acceptance, an adequate stock of replacement parts and a simplified series of contract, report and time forms to preclude misunderstandings and errors. All these factors add up to a customer's insurance for good lighting—and also add up to a contractor's insurance for profits.



TWO BENDS, each 90°, are made in one length of 2-inch conduit with one-shot bender equipped with bend indicator. Savings (over two elbows) were \$4.36 in material and labor at \$3.00 per hour.



DOUBLE TIER of 12 parallel 3-inch conduits required handling of only 36 pieces of material. Use of field bends cut threading and assembly time in half.



IN CLOSE QUARTERS, like this switchroom, installation of bent conduit lengths was easier than manufactured elbows. Wide sweep of ells simplified cable pulling operation.

Contractor Finds Field Bending Saves Time

and materials on conduit work. Cost studies on two Milwaukee projects show economy of "one-shot" bending technique.

FIeld bending of conduit with a motorized, hydraulic "one-shot" bender saved 548 hours of labor and some \$782.00 of material on two electrical construction projects of Magaw Electric Company in Milwaukee. In all, 874 bends were made—almost all of the 90° type—in conduit ranging from 1-in. to 3½-in. diameter. The reported savings are based on past experience on other projects where elbows and couplings were used on right-angle offsets. Elbows were used on both jobs in difficult places. So a combination of both methods is probably the answer on most work.

Statistics of this type indicate a growing trend to field bending of conduit, particularly since the introduction of the "one-shot" bender. With its semi-circular forming shoe and long ram, this unit makes a 90° bend in one operation without the necessity of "inching" the conduit as with multi-step techniques using short shoes and short ram travel. If motorized, the semi-automatic operation of the unit assures identical repeat bends where quantities of similar offsets are required. Take into account the elimina-

tion of mechanic fatigue and the resultant increased efficiency is obvious.

Field bending of conduit, instead of using elbows, has become standard practice on Magaw projects. Use of this method over the past few years revealed these advantages:

1. The jobs are finished in less time.
2. Considerable savings in labor and material accrue.
3. It is much easier to pull wire through the wide sweep of field-bent ells.
4. The mechanics like the technique and are proud of their workmanship and a better looking job.

A breakdown of the above statistics indicates that 621 right-angle bends were made in conduit from 1-in. to 3-in. diameter on the 2-story Milwaukee Vocational School job. Only three elbows were necessary. Savings totaled 427 hours of labor and \$438.56 in material.

On the second project, the Mitchell Field Air Terminal, more small conduit and no thin wall were used. Hence, the savings were less. However, a total of 253 bends (including "kicks") were made in 1- to 3½-inch

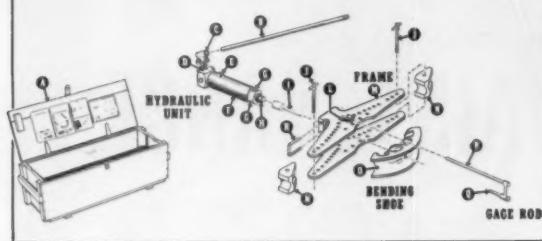
diameter conduit. Five 1-in., four 2-in. and two 3½-in. elbows were used. Savings on this job included 121 hours, eight minutes in time and \$343.77 in material (see accompanying time study chart). A Tal 4-in., motorized, one-shot bender was used.

Less Material Handling

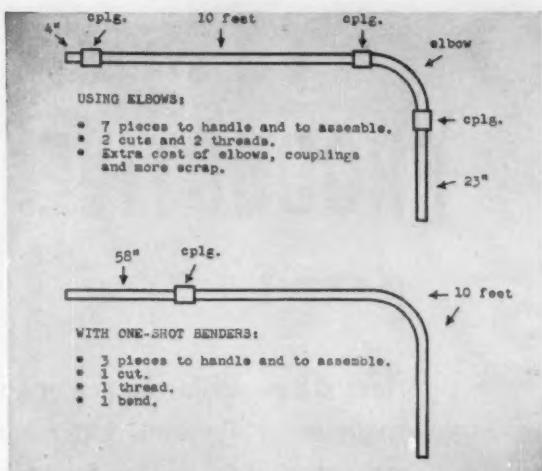
Biggest advantage of bending is the reduction in material handling and assembly time. Normally, a field bend involves three pieces of material (one full length of conduit, one coupling and another piece of conduit) plus one cut and one thread for a typical run (see drawing). Using an elbow in this same run would involve 7 pieces of material, two cuts and two threads, plus the extra assembly time.

Take, for example, one run of 12 parallel 3-in. conduits (two tiers, six per tier) on the airport job. With field-bent ells, a total of 36 pieces of material were handled and assembled and 12 cuts and 12 threads were made. And the runs were easy to install, particularly in "tight" places. If standard elbows had been used, there would have been some 76 pieces of material

One-shot Portable Pipe Bender Sets Up In Two Minutes, Shapes Complete Bend In One Setting



COMPONENTS OF BENDER used on the airport job. Note semi-circular bending shoe to make one-shot 90-degree bend in conduit.



LESS CUTTING, threading and assembly of conduit sections is the rule when field bends are used. Note the comparison between identical conduit runs in above drawing.

TIME STUDY CHART—FIELD BENDS VS ELBOWS—MITCHELL FIELD AIR TERMINAL BUILDING

Conduit Size	No. of 90° Bends	*Bending-Time (Minutes)		** Elbow-Time (Minutes)		Time Saved by Bending (Min.)		Material Cost				Savings in Material Cost	
		Per Bend		Per Bend		Per Bend		Bending (Conduit)		*** Elbows			
		Per Bend	Total	Per Bend	Total	Per Bend	Total	Per Bend	Total	Per Bend	Total		
1"	106	7	742	30	3,180	23	2,438	\$0.33	\$34.98	\$0.63	\$66.78	\$31.80	
1 1/4"	15	10	150	40	600	30	450	0.475	7.12	0.815	12.22	5.10	
1 1/2"	5	15	75	45	225	30	150	0.68	3.40	1.115	5.58	2.18	
2"	37	20	740	50	1,850	30	1,110	1.05	38.85	1.73	64.01	25.16	
2 1/2"	73	25	1,825	65	4,745	40	2,920	2.74	200.02	6.15	448.95	248.93	
3"	5	30	150	70	350	40	200	4.35	21.75	10.47	52.35	30.60	
Total			3,682		10,950				\$306.12		\$649.89		
			Min. or 61.36 Hours		Min. or 182.5 Hours							\$343.77	

Est. Savings: 7,268 Min. or 121.13 Hours

Notes: * Bending—time for handling and bending conduit

** Elbows—time for cutting, threading and assembling elbows and couplings.

*** Elbow cost includes cost of additional couplings needed.

Time Studies: By John Schleier, Magaw Electric Company foreman in Air Terminal project.

to assemble, involving 24 cuts and 24 threads. Based on the extra work involved with elbows, Magaw engineers estimate 100 minutes for two men to install a 3-in. conduit line with one 90° elbow. This compares to 60 minutes for one man when using a field-bend made with a one-shot bender. Including cost of material, savings are about \$7.90 per right-angle offset.

Use on Small Conduit

One-inch rigid conduit was also offset with a one-shot bender. Normally, conduit of this size is bent with a hickey or hand bender. Because there were 106 90° bends involved, the power bender was used to assure identical offsets.

Still greater savings are obtained where two 90° bends are made in one length of conduit. Two operations of the one-shot bender complete the double offset.



JOHN SCHLEIER, Magaw construction foreman on airport project, inspects 3-inch conduit bends in portion of power house installation.

5 STEPS TO . . .

PRODUCTIVE MAINTENANCE

PART I

Here's how maintenance men can organize their operations to effectively meet demands placed upon electrical inspection and service by increased industrial mechanization.

1. Gather complete equipment data
2. Determine extent of routine maintenance
3. Establish routine controls
4. Evaluate for critical maintenance
5. Establish a planned program

TODAY throughout industry there is a progressive movement towards greater mechanization. Operations are being controlled automatically to an ever-increasing degree and, where lines of individual machines are co-ordinated to function in tandem as unified units, continuous processing is growing in acceptance. With this trend in evidence, more and more importance

is being placed upon maintenance, for maintenance is proving to be the vital key to continuity of production.

As the importance of maintenance grows, so does the responsibility of the individual or department charged with that assignment, for equipment is constantly becoming more complex, and intelligent inspection and repair therefore requires more maintenance know-

how and numerous specialized skills.

The theory behind productive maintenance is not new, for it has long been the aim of management to increase production, protect capital investments and lower overall costs by minimizing outages in the electrical system. This has been accomplished to varying degrees by utilizing men, materials and tools in accordance with different plans in many different industrial plants.

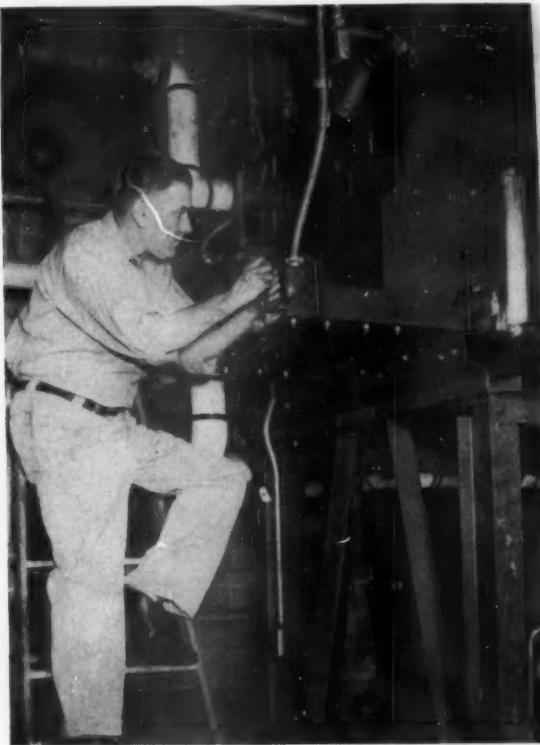
However, by following tested procedures and organizing maintenance operations in a logical sequence, it is possible to improve even the best of the systems now in use. Since different programs are dictated by local conditions in different plants, no attempt is made here to prescribe fixed rules or techniques. Instead, emphasis is placed on a few fundamental principles so that, by adjusting local operations to comply with these basic directives, any plant can develop a maintenance program which is economically sound and technically practical.

By putting these fundamental principles to work, it will then be possible to:

(1) . . . obtain greater production from each machine by substituting



INVENTORY of plant equipment should be complete, recording nameplate data and application of every piece of electrical equipment on a separate card. These cards, serving as plant property records, may be indexed by class or type.



CRITICAL EQUIPMENT should be definitely included in a productive maintenance program, whereas machines not essential to production (such as this air-conditioning motor) need not be serviced as frequently or as thoroughly.



INSTRUMENTS can contribute greatly to intelligent testing, for visual inspections and mechanical tests cannot possibly reveal internal circuit characteristics. Instruments are stethoscopes for measuring industrial heartbeats.

planned short-time shut-downs for unscheduled break-downs of uncertain duration,

(2) . . . keep work flowing smoothly through the plant by keeping all machines in an assembly-line set-up operating on schedule, at their maximum rate, in step with all other machines on the same line,

(3) . . . improve maintenance budget effectiveness by balancing work loads more efficiently, reducing delays in dispatching, reducing overtime maintenance and promoting closer cost controls on materials. These results are obtainable by planning a maintenance program in accordance with five steps, taken in the following sequence.

Step 1. Gather-Complete Equipment Data

First procedure in setting up an intelligent productive maintenance program is to conduct a survey of all electrical equipment in the plant. In that way you will know not only what you have but where it is located.

For proper identification each unit should be numbered or lettered, using a system that will specify the building,

floor, bay and machine exactly. This number is plainly stamped, stencilled or painted on the machine so that identification is accurate and fast.

These machine inventories can be greatly simplified by using cards or record sheets to list general data, plus such special information as is deemed desirable or necessary. Cards can be filled in by area mechanics or engineers in training. Some plants even allocate this assignment to maintenance clerks, since they have found that familiarity with equipment can be promoted by these routine notations. With this familiarity, clerks can then work more intelligently when subsequent clerical reports become necessary. Even when record cards or sheets are filled in by clerks, however, they should be reviewed by the plant maintenance engineer who can then add such additional data as he desires.

This 2-part article is based upon a series of maintenance forums being presented in 26 of the nation's major cities by the General Electric Company. The highlights of these articles are also contained in a 25-minute full-color motion picture which will be made available for trade and association showings upon completion of the forums currently being held.

Records, to be complete and useful for future reference, should include a comprehensive description of the equipment, such as application, rating, serial number, manufacturer, vendor or agent, purchase order number, cost, and machine or equipment number. Space should also be provided so that a record can be made of the original location of the unit and all subsequent changes.

These records constitute a plant property inventory and, in addition to identification of the equipment, they should contain notations of original and installation costs.

Records can be further improved by classifying equipment by class or type, then cross-indexing this information in the files to provide an easy way for finding the total number of any specific item.

So, as the first step in planning a productive maintenance program, it is necessary to go through the plant in a careful, thorough manner, recording nameplate and application data for every piece of electrical apparatus on a separate file card or record sheet. This step is of definite importance, for these records will form the basis for

controlling all subsequent inspections, repairs and maintenance costs.

Step 2. Determine Extent of Routine Maintenance

Although maintenance generally pays dividends in improved efficiency and reduced operational costs, it should be pointed out that extensive maintenance is not always warranted on all types of equipment. Therefore it is necessary to determine the importance of a machine or device, and to further determine the break-even point between useful maintenance or replacement.

By that, it is suggested that it is sometimes cheaper to replace some parts after they wear out rather than to devote time to their upkeep through preventive maintenance. As an illustration, a single punch press warrants considerable maintenance if its breakdown would affect the operation of sev-

eral other machines or production workers. However, if the load of the press could be readily picked up elsewhere while necessary repairs were being made, the need for costly maintenance is understandably not so essential.

Therefore it is important to analyze all equipment from a standpoint of importance to overall operations, and devote intelligent productive maintenance only to those items where the investment in time and parts is justified and will be repaid in some tangible form.

Step 3. Establish Routine Controls

After all plant assets have been recorded, a numbering system has been established and the importance and application of each item has been determined, it then becomes expedient to set up an inspection cycle. This cycle,

or time interval between inspections, ideally would strike a balance between waste and efficiency. That is, periodic checks should be frequent enough to prevent damage and outages, yet should be spaced far enough apart to eliminate wasted effort and needless service. Only by keeping and referring to records can this exact cycle be determined, for the extent of adjustments, lubrication, replacements or repairs found to be necessary on each visit will soon reveal whether the frequency of maintenance is excessive or insufficient.

Another way to determine this cycle is to assign specialized inspectors to check equipment in operation. These inspectors do not do any actual repair work themselves, yet their written records and reports can be used advantageously to determine proper maintenance schedules, scopes and procedures.

These reports, submitted in writing daily to the maintenance foreman, are then analyzed to determine material and labor requirements, estimated times for completing each job, and proper schedules for the maintenance crew. Orders for materials can then be intelligently placed and, if additional manpower is indicated, the necessary arrangements can be made in ample time.

Work-Order Programs

In developing a work-order program, it should be emphasized that there is no such thing as a universal procedure; no such thing as one "best" way to schedule work in all plants. Each plant has to develop its own system, with details tailored to satisfy specific cases. Yet all plants can benefit from patterns, systems and experiences encountered elsewhere, for the basic purpose of all work-order programs is a common one.

Work orders are actually bids for action. And, to expedite such action, basic data should be complete. This data should include the job number and location of the machine requiring service, department number for purposes of billing, description and urgency of the work required, number and type of craftsmen required, estimated labor and materials. Space should also be provided on work-order forms for the dates of reporting and completing a job, actual labor and material costs, plus approvals and comments by supervisors. Information should be complete enough to eliminate the necessity for rechecking missing essential data, yet should be concise to minimize paper work.

To have the system work properly,



MAJOR PARTS should be charged to specific jobs, although minor parts can be included on job-cost records by multiplying other charges by a fixed percentage factor. This method saves time and is relatively accurate.



OVERLOADS or current surges can contribute to the eventual oxidation of materials used in the original windings of motors, so it is important to check electrical characteristics under load, using instruments for this purpose.

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Productive Maintenance

... Starts on page 102

the rule should be steadfastly maintained that all work performed by the maintenance department must be covered by a work order—in writing. Experience shows that, when this rule is neglected, work is frequently called for that is unnecessary, improper or duplicated. Written orders permit intelligent screening and scheduling; they establish responsibility for initiation, they prevent misunderstandings and provide the basis for departmental billing. In emergency cases where the nature or extent of necessary repairs is not known until after the job is completed, it becomes necessary to make the order out at a later date. But, whether it is made out before or after the work is started, it is imperative to have an order for each maintenance operation.

Check Costs Again Estimates

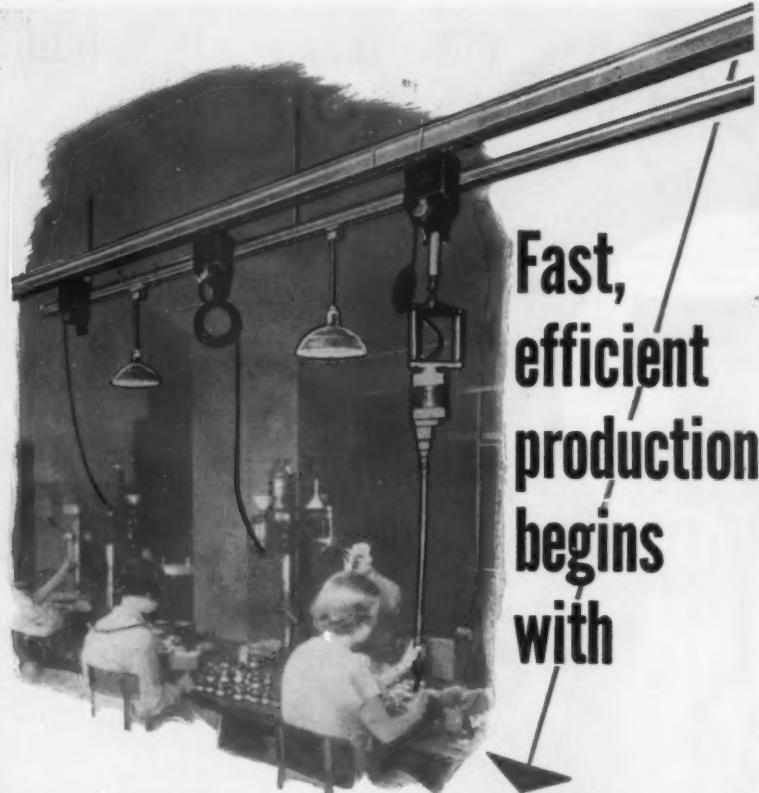
The value of estimating maintenance costs, then checking them against final actual figures, is quite important, for estimates definitely influence decisions to repair or replace equipment, and actual costs provide an intelligent yardstick for the measurement of results.

In tabulating actual costs, a compromise between accuracy and expediency is usually followed; listing exact costs of all major items of equipment or material required on a specific job, then adding a small percentage factor to include minor stock items such as lugs or solder, tape or connectors, nuts or bolts.

All estimates and final tabulations



EXTENT OF STOCK carried on hand should be governed by the importance of the items, their frequency of demand, the time required for delivery, available storage room, justified inventory investment, and similar factors.



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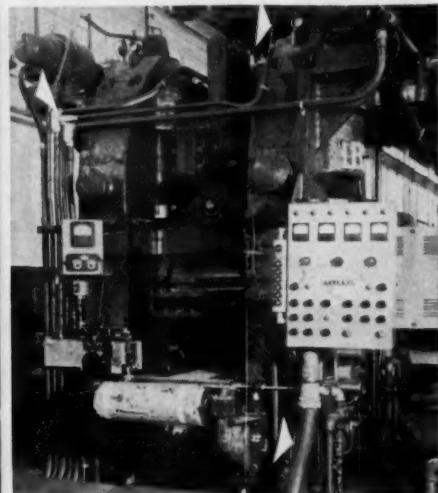
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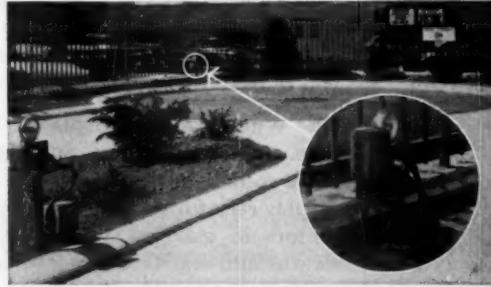


On a rolling mill, Sealite . . . CONNECTS MIS-ALIGNED OUTLETS AND ABSORBS VIBRATION.

Wiring on this rolling mill—installed in a steel plant by Harlan Electric New York Corp., Buffalo, N. Y.—was run in SEALTITE Flexible Electrical Wiring Conduit wherever offset installations had to be made and wherever there was operating vibration. (See 4" SEALTITE in lower right hand corner and 1" and 1½" SEALTITE in upper left and center of photo.) SEALTITE is perfect for this use because it can be cut on the job, is easy to handle, easy to attach to liquid-tight connectors and easy to flex. When vibration is present, SEALTITE's flexibility helps prevent damage to the conduit and the wiring it encloses.

In a chemical plant, Sealite . . . **RESISTS WATER, ALKALI, HEAT.** According to Ed Cieckiewicz, Plant Superintendent, Diamond Alkali Co., Jersey City, N. J., this 28" length of 1½" SEALTITE® Electrical Wiring Conduit is holding up very well under conditions which caused another conduit to fail rapidly. Temperatures in this furnace department room run

as high as 150°. The previous conduit dried and cracked in a short time and water was able to seep in and short the wiring. Alkali dust is also a constant threat. But when SEALTITE was installed these troubles ended. SEALTITE's tough vinyl cover protects wiring against oil, grease, water, dirt, chemicals, corrosive fumes and salt spray.



On outdoor electronic controls, Sealite . . . **PROTECTS VITAL WIRING AGAINST WEATHER.**

Because of space limitations, The Citizens & Manufacturers National Bank of Waterbury, Conn., had to build two driveways and install a steel turntable in order to set up a drive-in window. The turntable—which swings the car around in a 120-deg. turn—is electronically controlled by means of several light beams. All wiring to the electronic controls and switches is protected by SEALTITE Flexible Electrical Wiring Conduit. SEALTITE was chosen because its tough PVC cover stands up under heat, cold, rain and snow, and can be buried underground. SEALTITE requires no cumbersome tools, no special skill.



FREE BOOKLET! Write today for your free copy of Bulletin UA-530, describing SEALTITE Types U.A. and E.F. and their applications. The American Brass Co., American Metal Hose Branch, Waterbury 20, Conn.



AVAILABLE IN TWO TYPES

TYPE U.A.—First flexible conduit to be approved by Underwriters' Laboratories, Inc.

TYPE E.F.† (Extra Flexible)—meets standards set by J.I.C. Now available in machine tool standard light gray #257 from mill stocks.

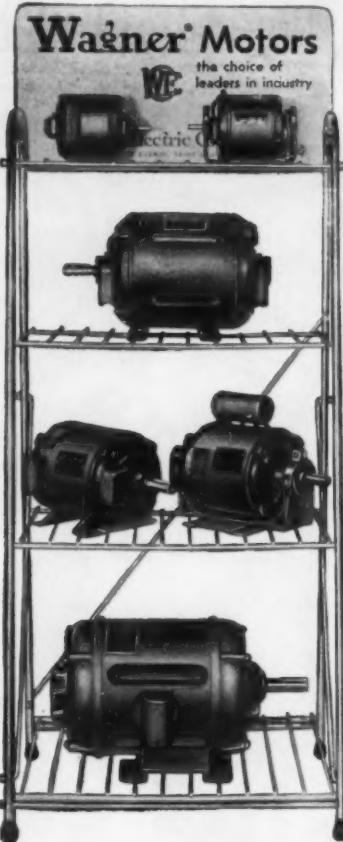
flexible, liquid-tight electrical conduit—an ANACONDA® product

Genuine Joe says:

"RACK
'EM
UP!"



Let this Merchandiser
build sales for YOU!
only \$9.95
with the purchase of any 10 Wagner Motors in one lot.

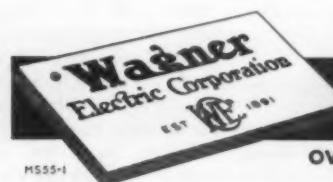


Boost your Motor Replacement Sales

A Wagner Motor Display Rack is just like a salesman in your shop. It puts Wagner Motors out where your motor replacement-minded customers can see 'em... read the nameplate... look over special features. It sells while you're busy with other jobs, other customers.

The Wagner Motor Display Rack is a good-looking salesman, too. It's chrome and cadmium-plated and has a three-color identifying sign at the top. You can get this display rack for only \$9.95 with an order of any 10 Wagner motors in one lot. Jet pump motors, shaded-pole fan motors and standard motors may be included.

So call your Wagner branch today... stock up on Wagner motors... and put the Wagner Motor Display Rack to work for you.



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OVER 850 AUTHORIZED SERVICE STATIONS
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M555-1

Productive Maintenance

... Starts on page 102

of cost should be as accurate as possible, for the data will have little meaning if accuracy is not obtained, and the time devoted to the necessary paper work will then be completely wasted.

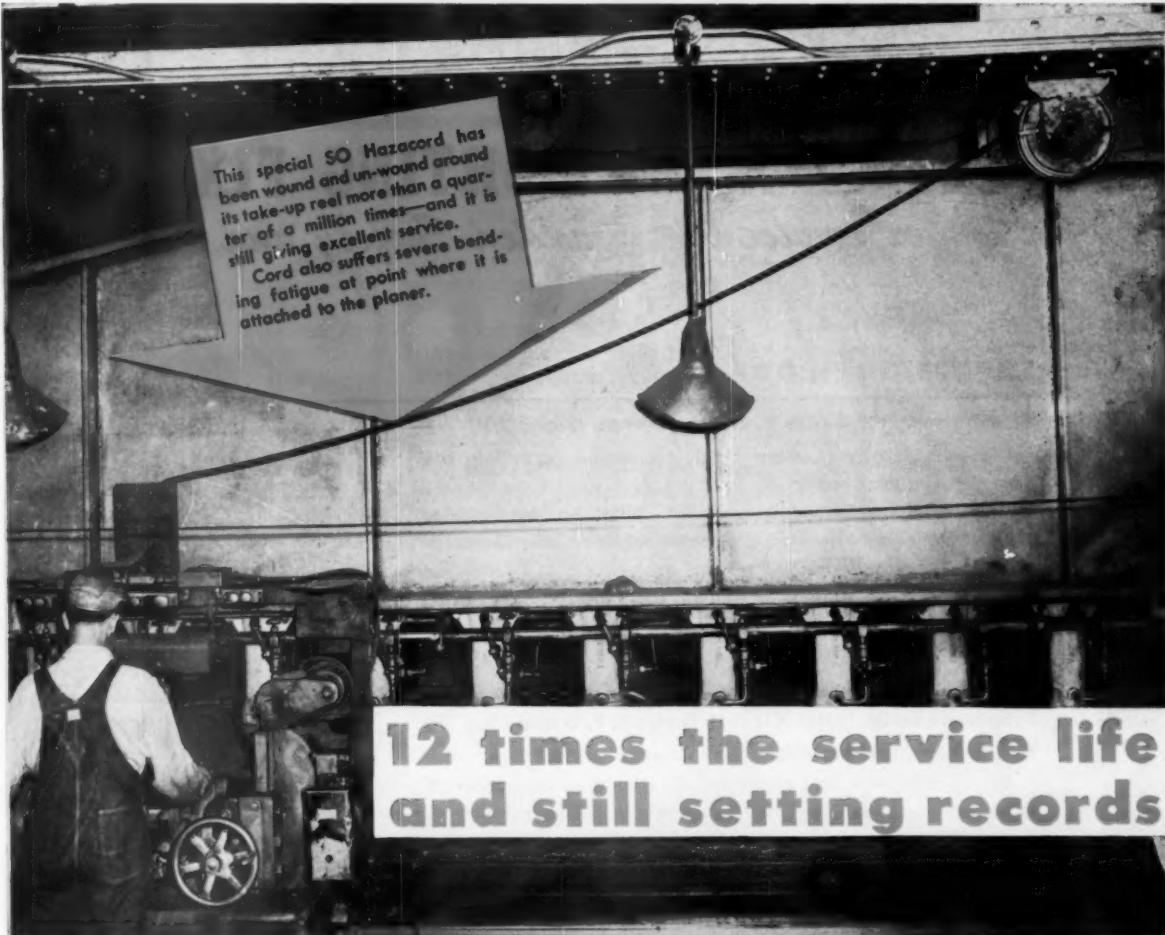
Estimates and actual cost sheets may then be filed as detailed, or they may be condensed and listed on a historical card—recording only the date of the repair, nature of work, cost and similar pertinent data which are of lasting value to the maintenance engineer.

In establishing any routine operations control system it is also important to have a standard inventory procedure, based upon experience and designed to secure maximum use from the money invested. Towards this end, first ask manufacturers for their recommendations for selecting and stocking renewal parts. Log these recommendations accurately, thereby minimizing checking and saving time when ordering actually becomes necessary at a later date. Personal experience is also valuable here, for the maintenance man knows whether or not his equipment is being used in its prescribed manner, under normal or abnormal conditions, at unusual temperatures or in corrosive atmospheres. All of these factors will have a bearing on the acceptability and service of standard parts.

Part II of this article will discuss the final two steps for effectively evaluating and establishing a critical maintenance program.



PLANT ENGINEER Ken Sill of the Manchester Biscuit Co. Div. of the United Biscuit Company of America is proud of the 40% spare capacity designed into the rewiring of the Fargo, N. D. plant. Here, he points to Unistrut channel wiring and support for outlets serving portable equipment along cookie lines.



12 times the service life and still setting records

Until recently, a large steel fabricator was plagued with costly failures on control cable to the carriage of a 45' planer. Ordinary Type SO cable was unable to withstand the great bending fatigue of constant winding and unwinding on a small take-up reel as the carriage moved back and forth an average of 45 times an hour for 90 hours per week. Cables had to be replaced about every six weeks.

Hazard engineers solved this problem with a special SO Hazacord construction. Combined with Hazacord's normal high standards of quality, this construction completely eliminated the fabricator's problem. *The special SO Hazacord has now been in service since April 1953—and is still giving excellent service.*

This successful installation is just one example of Hazard's ability to design Hazacord constructions for difficult installations. When-

ever you have problems involving a portable power supply, Hazard can help you eliminate costly down-time and power failures. Why not contact your Hazard representative today? Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, N. J.



Rely on Quality

PYLE-NATIONAL **LIGHTING FIXTURES**

for longer service life. added Safety and Efficiency

INDUSTRIAL

EXPLOSION-PROOF

Pyle-National LE Series (Class I, Groups C and D)

For use in locations where highly flammable materials are manufactured or handled.

Rugged, flame-tight cast aluminum alloy housings render internal explosions harmless, and insure safe operating temperatures. Threaded construction permits easy access to interior for wiring and lamp replacement. Available in many types and sizes.



DUST-TIGHT

Pyle-National DE Series (Class II, Group E, F, G and Class III)

For use in locations where flammable dusts are present in quantity.

Strong, one-piece cast aluminum alloy housings are designed to exclude dust from the interior and to avoid accumulation of dust on the exterior surface. Available in many types and sizes.

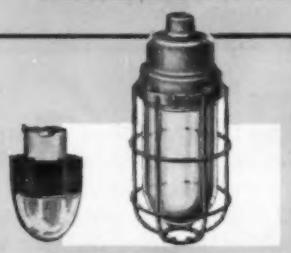


VAPOR-TIGHT

Pyle-National BO Series and Signal or Pilot Lights

For use in any outdoor or indoor location subjected to heavy concentration of non-flammable vapors, gases, dusts, or moisture.

Heavy-duty construction with efficient sealing features insures exceptionally long-life service. Full line for 10 to 200 watt lamps.



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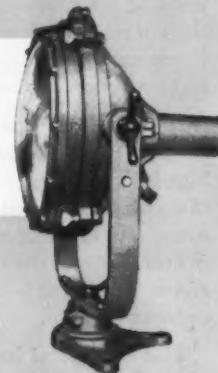


VAPOR-TIGHT PIT FLOODLIGHT

Especially designed for recessed or surface mounting in walls or ceilings of pits, subways, or other locations where heavy moisture prevails. Reflector can be pivoted to adjust the angle of beam. Front glass is heat and impact resisting. Water drainage slots on cover.

WEATHER-PROOF ENCLOSED FLOODLIGHTS

Sealed against moisture and dirt. Constructed throughout of cast aluminum and other corrosion-proof materials. Floodlights retain their original high efficiency output throughout an exceptionally long-service life with negligible maintenance and replacement expense.



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Practical Methods

Plane Docked by Electricity

EQUIPMENT

An electrically operated device for moving aircraft in to terminal gates has been installed by American Airlines at the New York International Airport. The "Lodair", perfected by engineers of Whiting Corp. and Westinghouse Electric Corp., is essentially a winch drive which pulls the plane on dollies flush with the pavement and resting upon sunken tracks.

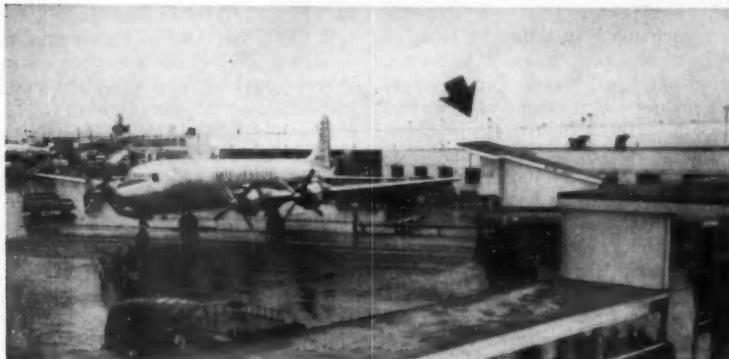
The operation enables passengers to enter or alight from the plane directly into the terminal without the customary walk to the plane under the weather.

The plane taxies its wheels onto the dollies, and the wheels are locked in place. An operator standing on the loading ramp starts the main drive motor by means of a pushbutton, which transports the plane sideways at the rate of 150 feet per minute until it is 6 feet from the dock.

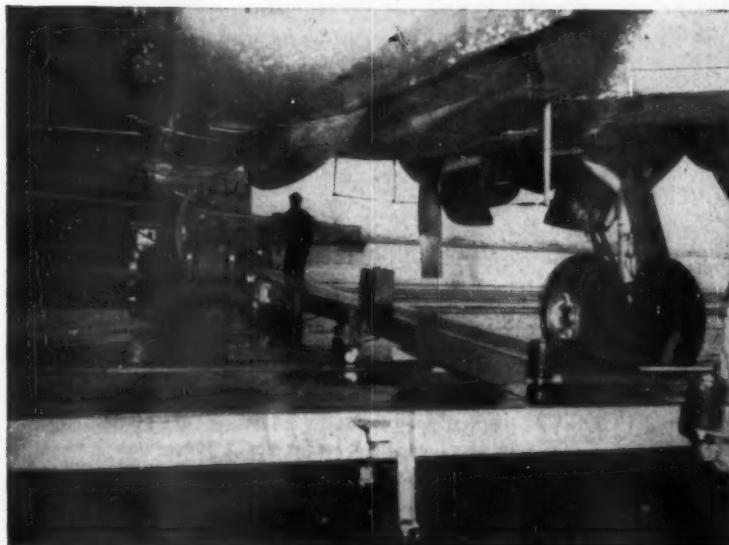
At this point, the plane is "inched" in at low speed until it is flush with the dock, movement being stopped by a limit switch which is contacted by the plane fuselage.

To enable travel away from the dock after loading, "out" buttons are pushed. The plane is stopped in the correct position, ready to taxi to the runway, by limit switches attached to the winch.

Multiple tracks for the nose wheel



WINCH-DRIVEN DOLLIES under main wheels draw DC-7 sideways to Lodair dock (arrow).



CONVEYOR carries passenger baggage and plane cargo to baggage room.

permit parking of at least ten principal types of aircraft in current use. Built-in electric heating elements prevent the winch and cable equipment from being affected by ice and snow.

A baggage conveyor belt on wheels is an integral part of the Lodair. Powered by three 5-hp explosion-proof motors, the conveyor transports air cargo and passenger baggage from the plane directly into a baggage room at the rate of 150 feet per minute, protected from the weather all the way.

Besides the customer convenience afforded by the system, it permits the parking of 20 to 25% more aircraft in front of a terminal and allows them to load and unload in 50% less time.

Progress Chart Improves Efficiency

MANAGEMENT

Efficiency of overall operations has been greatly improved at Gulf Electric Company, Houston, Tex., through the use of a wall-mounted progress chart. This large chart, shown in the photo, provides essential day-to-day information on all work in progress. The chart keeps essential data right out in the open where Fred Peters, chief engineer, can check it whenever necessary. Use of the chart has eliminated much guess-work and reduced phoning and hunting through papers for particular information. Fred can now make decisions during the day on the basis of accurate, readily available information.

The chart itself consists of a large piece of heavy white cardboard, ruled, with headings for each of 17 columns and a main heading for the whole chart. A sheet of clear plastic covers the whole surface of the chart and is tacked with the chart to the wall in Fred's office. Data is written on the plastic cover of the chart with a grease pencil. The thick lines of such a pencil are easy to see and can be readily wiped off the plastic with a small cloth. In this way changes can easily be made in data on the board and notes can be entered and erased when taken care of. The grease pencil never actually touches the white cardboard.

Headings and typical data on the chart shown are as follows (from the left to the right hand column):

1. "JOB NO."—Each job in progress has a number by which it is identified for record purposes. This column on the chart contains all job numbers.



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- ★ Sizes 6" to 48"

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Need a Good Pipe Cutter?



Try the new TOLEDO No. 20 with 6 rollers—recommended for use with power drives—works fine by hand, too.

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MACHINE CO. • Toledo 6, Ohio

Builders of the
World's Finest
Pipe Tools

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Power Pipe Machines



PROGRESS CHART on wall in office of Fred Peters (shown above), chief engineer with Gulf Electric Company, Houston, Tex., provides ready check on important details of all work in progress; has raised efficiency of overall operations.

2. "NAME OF JOB"—In this column, each job is identified by name of project or owner; e.g., Coliseum, Green-Peterson, Baker Oil. To get data on any job, it is only necessary to check down this column to the job name and then run right across the chart horizontally to pick up information under the other column headings.

3. "ENGINEER IN CHARGE"—This column shows which of the engineers of Gulf Electric Company is responsible for the job. Column shows Peters in charge of most jobs; Ross and Wood are other engineers listed for some of the jobs.

4. "MATERIALS PURCHASED"—This column has three subheads right under the main headline. These are "PANELS", "CONDUIT" and "WIRE". For each job on the board, a check mark is entered under each subhead when the material has been purchased.

5. "STARTING DATE"—The month and year of the start of each job is listed.

6. "PERMIT"—A "YES" is entered in this column if a permit has been obtained; a check mark, if it hasn't; and "NONE" if no permit is needed.

7. "TEMPORARY SERVICE"—A "YES" is entered if a temporary service is being used on the job; a "NO" if power is being taken from an existing electrical system.

8. "DRAWINGS APPROVED"—Again, this column has two subheads—"PANELS" and "FIXTURES". An "OK" is entered when all necessary drawings have been submitted and approved. A notation such as "PANEL FIXT. TRANS" might indicate items

on which approval is necessary.

9. "ROUGH IN"—This column indicates if the job has been roughed in. Where roughing-in is not complete, a percentage completion is given.

10. "COVER INSPECTION"—This column contains notations like "YES", "PARTIAL" or a check mark (indicating not needed) for cover inspections where inspection of part of a job must be made before covering over the work.

11. "PERCENT COMPLETE"—This column shows how much of the job (in percent of total dollar volume of job) has been completed.

12. "COMPLETION DATE"—A target date is given for completion of each job.

13. "FOREMAN"—The last name of the foreman on job is listed in this column.

14. "EXTRAS"—This column provides space to note details of any extras on a job.

15. "PARTIAL BILLING"—A percent of partial billing is shown for each job.

16. "FINAL INSPECTION"—Notes on final inspection can be entered here.

17. "REMARKS"—Day-to-day job details which require attention are noted in this column.

Elevator Provides Storage Lift

OPERATIONS

When heavy material is temporarily stored prior to its use by a manufacturing plant, the handling, storage,

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Choose *Century*
From the Wide
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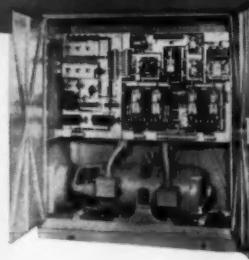
MOTORS

In Sizes From 1/3 to
400 Horsepower

SINGLE PHASE:



Split Phase Induction— $\frac{1}{6}$, $\frac{1}{4}$, $\frac{1}{2}$ H.P.
Capacitor— $\frac{1}{6}$ to 20 H.P.
Repulsion start, brush lifting, induction— $\frac{1}{2}$ to $7\frac{1}{2}$ H.P.
Write for Bulletin Nos.:
Split Phase 1-5P1
Capacitor 1-1P3
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SELECTIVE SPEED DRIVE:

A complete line of adjustable speed drives for coordinating all kinds of production processes.

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POLYPHASE:



Squirrel Cage Induction— $\frac{1}{6}$ to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
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$\frac{1}{6}$ to 15 H.P., single, double and triple gear reduction.

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All capacities— $\frac{1}{6}$ to 300 H.P.
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GENERATORS:

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DC, .75 to 200 KW

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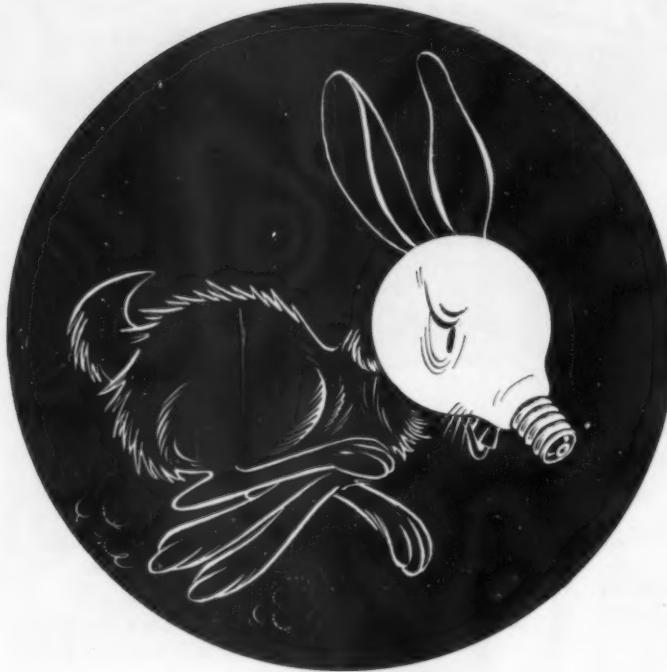
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The Meterabbit is a swift that swoops down on your light bills and builds 'em up, if you're not too quick for him. Send him packing by maintaining a goodly supply of efficient, dependable, long-lasting CHAMPION Lamps, and by following the practical, down-to-earth suggestions in the *Champion Maintenance Manual*.*



* A complimentary copy will be off to you quick as a rabbit, if you'll say the word.



CHAMPION LAMP WORKS
Broad Street, Lynn, Massachusetts

moving and lifting of the product constitutes a necessary operation frequently producing much wasted time, effort, space and equipment. This quite easily could have been the case in the Bedford, Ohio, plant of Borg-Warner's PESCO Products Division, for the storage of heavy metal bar stock could conceivably require the services of several men, cranes, industrial trucks or other heavy machines for handling this problem.

Thoughtful design, however, has converted this problem into a minor one, since the sturdy storage bins—fabricated from channel irons welded together to form rectangular cribs—flank a large, unenclosed, metal-shod hydraulic elevator platform. Bar stock is unloaded from trucks directly to the bed of the elevator, which can be adjusted to the height of any tail-board, and the elevator is then raised to the level of the bin in which the bars are to be stored, thereby making it necessary only to move the bars laterally into their proper crib.

Conversely, when bar stock is to be removed from the bins for production purposes, the hydraulic elevator platform is used to facilitate the handling of sizable quantities of material or, if only a single bar is involved, the use of an electric bridge hoist riding above the elevator bed is available for rapid, local use.

Since the bar stock is delivered in a variety of sizes and compositions, the ends of the bars are color-coded for prompt identification, thereby precluding the possibility of error in selection, the double handling of materials.



HEAVY DUTY hydraulic platform having a large-area diamond-grid steel deck is positioned between channel-iron racks for the storage of bar stock used in various production cycles. Elevator can be quickly raised to match a delivery truck tail-board or any of the partitioned bins, greatly facilitating handling of material.



Kindorf channel now approved by underwriters!

*FIRST
AND ONLY*

combination flush-mounting fluorescent fixture support and surface raceway to be approved by Underwriters' Laboratories, Inc.

channel and fittings specially designed for the job:

- 1 easy to wire patented "slot-up" channel. One-half inch knockouts on 6-inch centers in the fixture-mounting side.
- 2 special conduit-to-channel swing connector (patent pending)
- 3 end cap and snap-in closure strip for complete enclosure free of obstructions or sharp cutting edges.

safe . . . practical . . . easy to install . . .

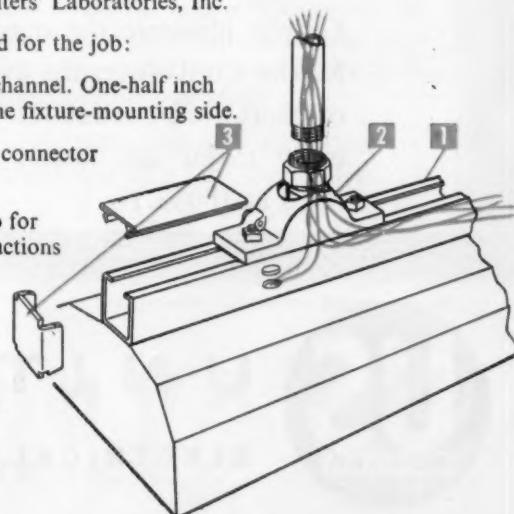
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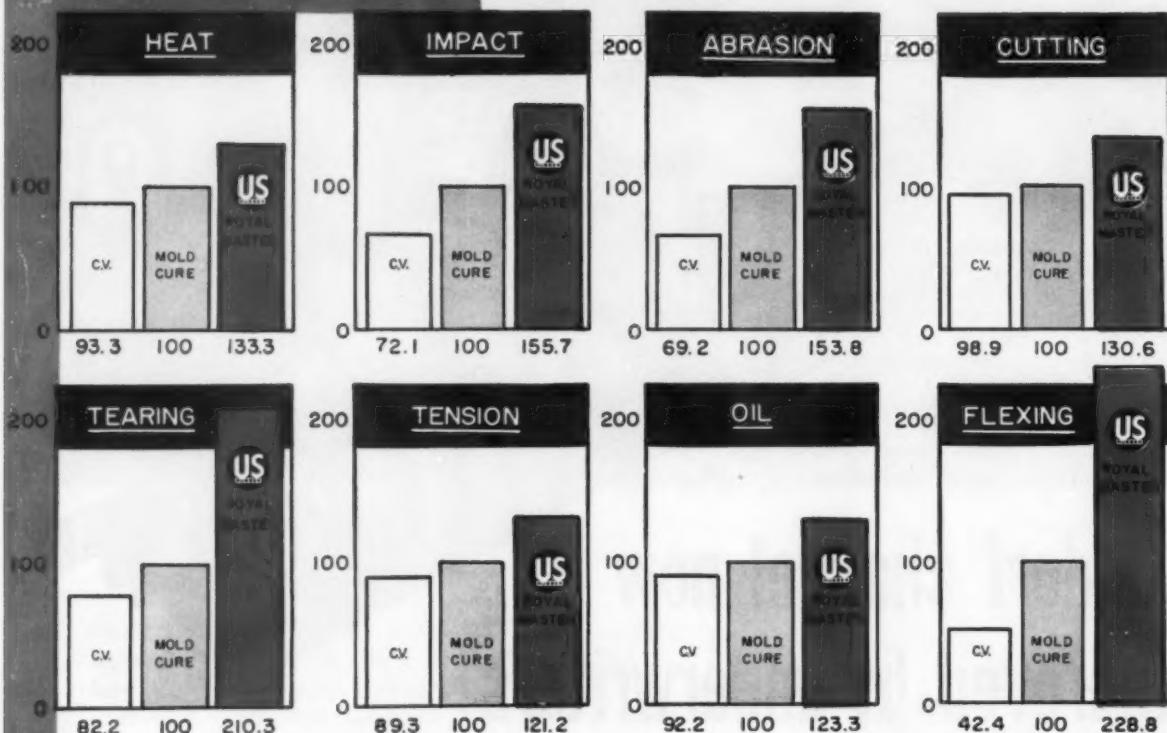
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New

U.S. ROYAL outperforms,



Comparative performance of portable cords related to major life factors.

Graphs illustrate the outstanding superiority of new U. S. Royal Master Cord—over the average of molded cords and the average of short-lived continuous vulcanized cords of other makes—on every major life factor. (Average of other molded cords is rated at 100%.)



UNITED STATES
ELECTRICAL WIRE AND CABLE DEPARTMENT

MASTER portable cord outlasts all others!

Comparative tests show U. S. Royal Master gives \$1.88 in value for every \$1.00 spent—almost twice the service value of the average of other molded cords!

LOOK FOR THE NAME—U. S. ROYAL MASTER

U. S. ROYAL MASTER

Two years ago, "U. S." engineers began a *complete reexamination* of portable cord construction, service life, and the causes of cord failure.

Over 10,000 tests were made. More than a thousand cords of all leading makes, including our own famous U. S. Royal Cord, were analyzed, tested, and compared.

Every life factor was considered and carefully evaluated, alone and in its relation to overall cord performance and service life.

Backed by 64 years of experience in the manufacture of electrical wire and cable, U. S. Rubber engineers then translated their findings into an entirely new portable cord, designed to surpass any other previously made.

Extensive tests, both in the laboratory and in outside plant installations have proved this new portable cord startlingly superior in every respect!

New U. S. Royal Master is unquestionably the finest cord you can buy!

From every standpoint, as the charts at left illustrate, new U. S. Royal Master is a finer, more durable cord—actually gives 88% longer life than the average of competitive molded cords—far longer than *any* other cord—surpassing even a hypothetical cord incorporating the best features of all those tested!

Far greater value, too! In spite of almost doubled service life, this great new cord is in the same price category as other molded cords—giving you \$1.88 in cord value for every cord \$1.00!

Prove to yourself the outstanding superiority of new U. S. Royal Master Portable Cord—in both service life *and* economy! Get in touch with your "U. S." distributor today!

Approved by Underwriters' Laboratories, Inc.

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QUICKEST
MOST ACCURATE

The
"TRACT"
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for dry wall

RIGID
"Front of Stud"
MOUNTING
EXTRA HEAVY
Box Wall
Sections



UNION INSULATING CO.
Parkersburg, West Va.

**ELECTRIC HEATERS
BOOST DRIVE-IN-THEATRE
WIRING**

[FROM PAGE 85]

labor. A conventional ramp installation for speakers and indicator lights only would have taken about 200,000 feet of No. 12 and No. 14 parkway cable. The electric heater system required the installation of an additional 76,000 feet of No. 8 Trenchlay cable, plus the additional outlets, circuit breaker panels, underground duct and larger service entrance equipment.

Our construction department records on this project showed a total of 1,100 labor days expended over an 18-week span for the complete installation. Several hundred of these labor days can be traced directly to the requirements of the electric heater system work. For the first ten weeks, 4- and 5-man crews were used. During the following six weeks, 20-man crews were on the site. At the peak, for the final two weeks, 35 men were assigned to complete the job.

Because of the electric heaters, the Gary theatre operated from Thanksgiving through April 1st of last year—four months when normally it would have been closed. On many January and February week-ends, all 500 heaters were rented and Mr. Wolf feels he would have been justified in installing 700 or 800 units. In addition to the extra box office and concession stand play, he feels the year-round operation gave him a "found" return on his investment, kept his staff intact and property in good shape, and developed the outdoor theatre habit among a regular clientele. Mr. Wolf is so sure the venture was worthwhile that the Gary theatre will remain open all this winter. In fact, he is considering wiring other Y & W drive-in theatres for in-car heaters—even though ripping up an established outdoor facility for installation of additional electrical facilities can be relatively costly.

From an electrical contractor's standpoint, we feel the growing trend toward in-car heater installations will be a profitable one. The market is there waiting for the contractor and manufacturer to promote and sell the electric heater idea. It can be done to the mutual advantage of the outdoor theatre operator, the equipment supplier and the installing contractor.

Work of this type is particularly desirable to the electrical contractor since it can be handled quickly and efficiently with minimum interference from other trades.

THE
Modern Way
ELIMINATES
BAR HANGER

FASTER
INSTALLATION
LOWER
UNIT
COST



QUICKER
SMOOTHER
KNOCKOUTS



USE UNION D-Bracket boxes
anywhere that fixture does not
have to be located in exact
center of space.

UNION INSULATING CO.
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Receptacles, Plugs and Switches



—first line of defense
against weather, water
and industrial hazards!

R&S receptacles, plugs, connectors and switches are available in an endless variety of weatherproof, waterproof and explosion-proof types, sizes and assembly combinations—the most complete line of fittings ever made to meet every industrial operating requirement.

Russell & Stoll quality adds maximum permanency and protection to your wiring plans. The finest in materials, rugged construction, precision manufacture and exclusive design features, combine to assure ease of installation, reliable operation, low maintenance and long service life.

Write for literature concerning items in which you have a specific interest.



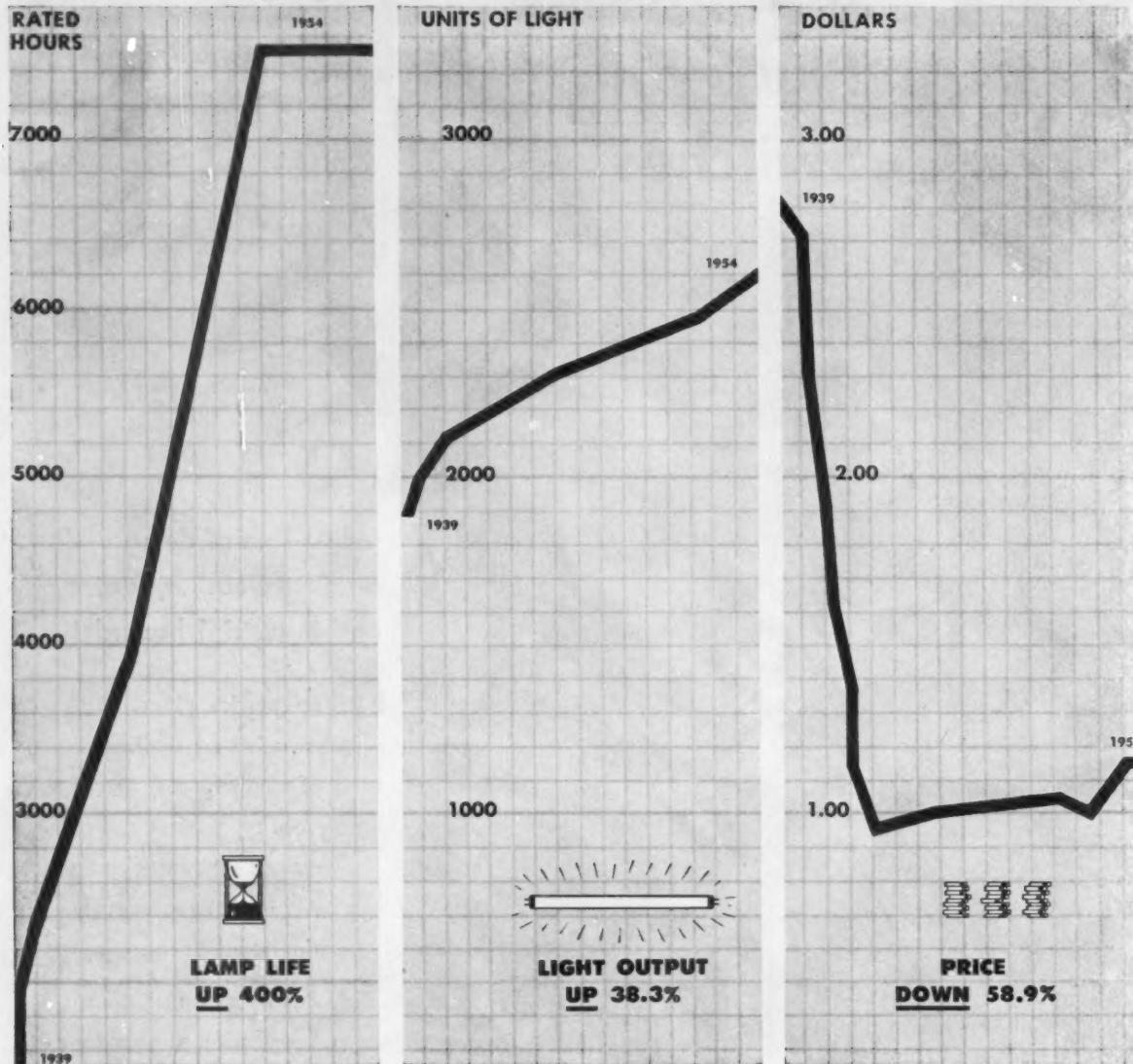
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**16 times more value for
your fluorescent lamp
dollar than in 1939**



Today you don't have to pay more than \$1.15 for the finest fluorescent lamp made: General Electric. Sixteen years ago it would have cost you \$2.80 or \$1.65 more. And while price has been going down, we've been pushing quality up. General Electric has upped light output 38%, increased lamp life 400%.

In terms of what you really judge lamps by, a General Electric 40-watt fluorescent lamp that lists at \$1.15 today is a *16-times bigger value than it was in 1939*.

For further information, contact your G-E lamp supplier or write to Lamp Division, General Electric, Department 166-EC-1, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL  ELECTRIC

Product News



Electric Baseboard Heater (1)

New electric baseboard heaters have been added to this line. Designed for modern living, heaters are for use in homes, offices, and institutions. It is low-level perimeter heat that spreads a shield of comfortable warmth against cold walls from floor to ceiling, without drafts or sudden temperature changes. This heat is automatically controlled at the desired level by wall-mounted low or line voltage thermostat. Baseboard units have the same patented, cast-aluminum heating element which is used in all Electromodes. All electric wires are insulated, embedded and completely sealed within this finned aluminum casting. Heater is designed so that a completely harmonious installation can be made which conforms to the dimensions of any size room. Blank sections for extension, right and left-facing endpieces, and corner pieces, all matching the basic units, may be used to carry out an unbroken baseboard effect. Basic unit is 32-in. long, 8½-in. high and 3-in. wide, with a capacity of 600 watts, and operates on 120 or 240 volts. Finished in silver grey hammertone. If desired, units may be painted to blend with room color scheme. Literature is available.

Electromode Corporation, Rochester, N. Y.



Control Cable (2)

New flexible control cables with from 5 to 24 conductors are now being manufactured in sizes 18 through 10 Awg. Conductors in the new Bronco 60 certified control cable are made of pure, annealed electrolytic copper for maximum flexibility and flex-life. Insulation over the conductors is heat-resistant type RH

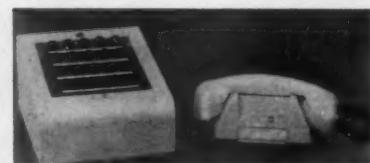
rubber. Singles are coded with permanent colors. The jacket is branded every two feet. The name, type, size, number of conductors, rated voltage, and "P116BM" (on sizes 14 and larger)—flameproof approval number of the U. S. and Pennsylvania Bureaus of Mines—are vulcanized permanently into the protecting sheath. Cable will find application in all types of control, recording, metering and signal transmission circuits. It can be pulled into conduits, or ducts, or installed in the open.

Western Insulated Wire Co., 2425 East 30th St., Los Angeles 58, Calif.

Wire (3)

A new ivory parallel-conductor indoor remote control wire with highly visible polarity identification in 2- and 3-conductor types has been announced. On 2-conductor remote control wire the outer edge of one of the parallel conductors will be striped black; on the 3-conductor the edge of one outer conductor will be striped black and the edge of the other outer conductor will be striped red.

General Electric Co., Bridgeport 2, Conn.



Telephone System (4)

A new private telephone system designed to equip motels with hotel-type telephone service, called "Motel-O-Phone". Unit operates through an easy-to-operate, pushbutton central station. From the central station any Motel-O-Phone equipped room can be called to make "wake-up" morning calls, relay information, etc. Guests can call motel manager too, for room service, information, etc. All conversations between room units and central station are private. Central station has been designed to handle a maximum of 20 room phones. To equip more than 20 rooms, another central station can be interconnected to give the system a capacity of 40 phones. In this manner the system can be expanded to handle up to 200 telephones. Each system is equipped with a power supply which is plugged into any 110-volt, ac, 60 cycle outlet to put the system into operation. A 2-conductor wire is run from each room phone to the central station.

Connecticut Telephone & Electric Corp., Meriden, Conn.



Solderless Lugs (5)

Two new solderless lugs are VT and LO 2-hole collar in 6 sizes from 14 to 1000MCM wire ranges. Both lugs are produced from pure electrolytic copper. They offer double secure mountings where close spacing must be maintained and where connectors must not turn and come into contact with each other. VT and LO are advanced in mechanical design, compact, shockproof and cool in operation.

Isco Corporation, Cincinnati 27, Ohio

Plastic Tubing (6)

An improved formulation for black Temflex 105 plastic tubing has been announced. It is approved by Underwriters Laboratories for continuous operation at 105°C. The modified formulation provides improvement in heat deformation characteristics and greater resistance to "cut through". In addition to these improvements, this modified formulation provides enhanced color stability under conditions of sustained operation at elevated temperatures.

Irvington Varnish and Insulator Division of Minnesota Mining and Manufacturing Co., Irvington, N. J.



Lighting Fixture (7)

Recessed units featuring new Parglo louvers have been announced. Louvers are of welded steel construction and automatic alignment makes unit adaptable for use in any type of ceiling. It gives a "soft" light from parallel glowing fins. There are no loose parts, snaps or screws, which means one-man installation. Construction assures positive alignment and eliminates vibration.

Eastern Fixture Company, 170 Vernon St., Boston 20, Mass.

NEW midwest SNAP ON CLAMP



ENGINEERING

This new clamp has been carefully engineered to provide proper relationship between these factors:

★ *Location of the indentation*

★ *Length of the conduit support area*

★ *Length of the base*

SNAP ON ACTION

Snap action indentation holds clamp firmly to conduit; frees both hands for work.

MATERIAL

Material is 13 gauge (.090") x $\frac{3}{4}$ "; this provides completely adequate strength.

FABRICATION

Extra care with the production dies provides a cleanly stamped, burr-free clamp. Clamp is thoroughly cadmium plated for protection against corrosion.

• Here is another Midwest development in providing quality fittings. "Quality" is just a condensed way of saying: "Getting the total job done — right — with the most inexpensive combination of material and man hours." Engineering and producing quality fittings to meet the highest standards of electrical wiring installations is our objective at Midwest.



Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1629 W. WALNUT STREET
Chicago 12, Illinois

**Cable Stapler****(8)**

Romex and non-metallic cable is speedily fastened with this automatic cable stapler. The gun shoots a heavy staple with each squeeze of the trigger, fastening cables or tubes to many types of building materials. The stapler loads heavy wire staples in many leg lengths up to $\frac{3}{4}$ -in. long. Its automatic chamber feeds staples one at a time into a driving hammer. Staples are set around the wire or tube to a pre-determined depth avoiding fracture to the material.

The Heller Company, 2153N Superior Avenue, Cleveland 14, Ohio

Slot Wedges**(9)**

Class "H" slot wedges for high-temperature insulation. Suggested for replacing flat strips, they permit better utilization of slot space and reduce rejects due to tearing of wire insulation which sometimes occurs when flat wedge is driven into slot. These wedges have a dielectric strength in excess of 100 volts per mil, excellent mechanical strength and resistance to the various silicone varnishes. Stock sizes available in widths from $\frac{1}{8}$ -in. to $\frac{1}{4}$ -in. and in thicknesses of approximately .020-in. and .030-in.

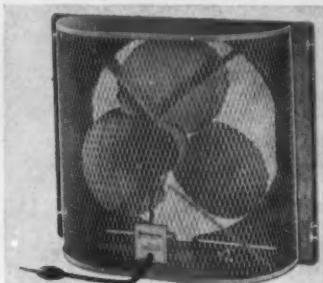
Silicone Insulation, Inc., 567 Third Ave., New York 16, N. Y.

**Infrared Brooders****(10)**

A new line of infrared-lamp brooders has been designed to fill a need for an inexpensive unit to meet competitive conditions facing farmers and hatchery operators. These units find widespread

application: brooders for all varieties of poultry, pigs, lambs, turkeys, calves and other stock; thawing frozen pipes; hair dryers; defrosters; therapeutic lamp-holder; spotlights; and other local heat tasks. Reflectors are heavy gage steel with infrared baked grey-hammerloid, weatherproof, heat-resistant finish. Unit uses 250-watt R-40 infrared lamp; has 6-foot heavy duty cord and plug.

Jackson Electrical Company, 900-910 W. Van Buren St., Chicago 7, Ill.

**Window Fan****(11)**

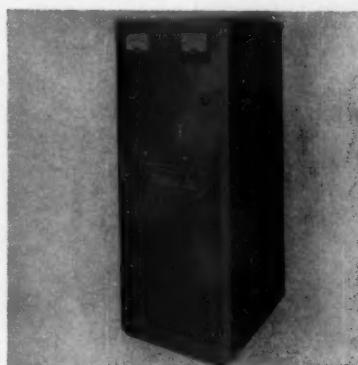
A new 20-inch window fan, Model 520, is especially designed for the volume price field. It delivers 3500 CFM with a 1/10 hp 2-speed motor. Other features include a baked enamel finish, special protective mesh grill, and sliding panels which allow fan to fit windows 22 inches and larger. Among other fans in the new line for 1955 are portable, deluxe and reversible 20- and 24-in. models.

International Oil Burner Co., Fan Division, 3800 Park Ave., St. Louis 10, Mo.

**Drop Light Reel****(13)**

Models 700, 800 and 900, 20-ft., 30-ft. and 40-ft. respectively, have been added to the Cordomatic line of drop light reels. Features of these reels are crack-proof phenolic pistol-grip handle equipped with a Levolier toggle-action switch and socket; a chrome reflector with a swing-open guard; kink-proof Neoprene cord; fool-proof reel locking mechanism; heavy gauge steel casing; all chrome mounting bracket that permits optional wall or ceiling mounting.

Cordomatic Division, Vacuum Cleaner Corp. of America, Philadelphia, Pa.

**Selenium Rectifiers****(12)**

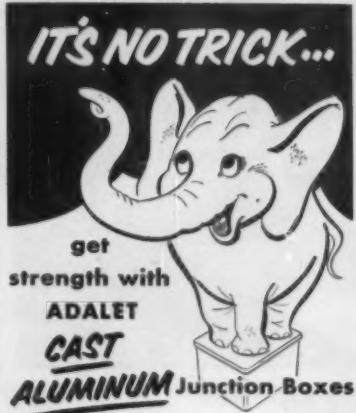
A line of selenium power rectifiers has been designed for widespread industrial application. Units are rugged and highly efficient, with a power factor of 97% and a ripple of approximately 4%. Models are available in fan-cooled types, convection-cooled types, combination convection and fan-cooled types and water-cooled types. Units have no moving parts, and their copper bus bars operate at low current density.

Norma-Hoffman Bearings Corp., Walker Div., Stamford, Conn.

**Circuit Breaker****(14)**

A 400-ampere molded case circuit breaker has been developed. The new "KL" frame breaker is designed to bridge the gap between present 225-amp model and the 600-amp model. It measures 9 inches wide, $15\frac{1}{2}$ inches high and $5\frac{1}{2}$ inches deep, including handle. It is designed for use in panelboards, switchboards, motor controls, bus duct plugs and individual enclosures. Unit is a thermal-magnetic circuit breaker with quick-make, quick-break operating mechanism. Interchangeable trip units provide continuous rating versatility from 125 to 400 amps. Common trip operation is retained and an over-current on any pole kicks out all poles simultaneously. Breaker is available in ratings from 125 to 400 amps; either 2- or 3-pole; 600-volt ac or 250-volt dc, 25,000-amp maximum interrupting capacity.

I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Philadelphia 30, Pa.



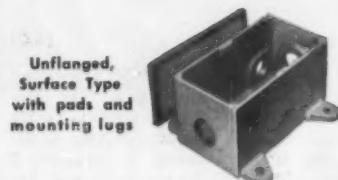
For any junction box installation, where STRENGTH . . . plus lightweight and weather-proof construction . . . is important, look to Adalet for.



Flanged,
Flush Type



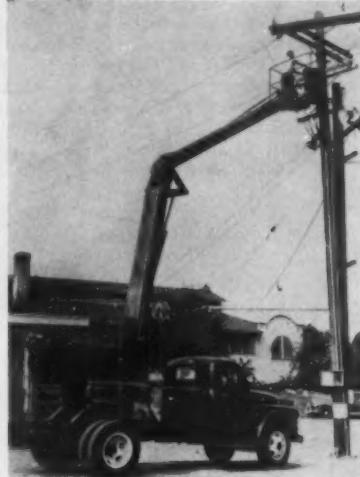
Recessed Cover,
Flange Type



Available in a wide range of standard and special sizes, Adalet cast aluminum junction boxes are drilled and tapped to your specifications.

Write for Bulletin G and also Bulletin F describing Explosion-Proof Junction Boxes and Switch Fittings.

THE Adalet MFG. CO.
14300 LOBAIN - CLEVELAND 11, OHIO



Aerial Platform (15)

A new hydraulically-operated aerial platform, known as the Giraffe, Model I. G. 40, for use in electrical construction, street light maintenance, overhead construction and maintenance in industrial plants. Operated by its own independent power source, it is sold as a completely self-contained unit that can be easily installed on a truck, barge, dock, trailer, flatcar, etc. With a two-section boom that can put a workman 40 feet into the air, Giraffe can handle up to 450 pounds at any radius with no outriggers, can handle 1000 pounds at any radius with outriggers. The boom can be rotated continuously in either direction and its two sections can be moved up or down independently or at the same time. Insulation is provided to protect the upper end of the boom and platform against 7500 volts. It also features foot-operated controls on platform.

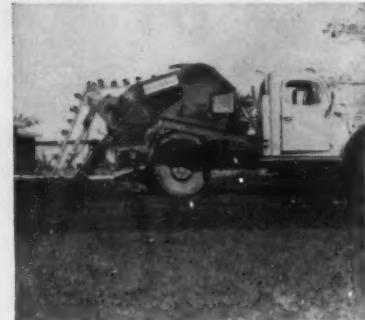
Pitman Manufacturing Co., 300 West 79th Terrace, Kansas City 14, Mo.



Meter (16)

A new 10 kv insulation resistance meter, designed to measure the degrees of insulation resistance, polarization index and leakage current. Device is portable and provides for the making of dc over potential tests. Meter will measure insulation resistances up to 200,000 megohms at 10 kilowatts. Featuring resistance reading directly for specified voltage, and dc voltage output continuously adjustable over a range of 0-10,000 volts dc of either polarity, it will handle capacitances normally found in large, high voltage apparatus. Meter includes a built-in voltage stabilizer, which provides accurate current readings, plus a high sensitivity and readability of .02 microamperes per scale division on a low range of 3½-in. scale. It requires a power supply of 115 volts plus or minus 10 volts, 60 cycles ac, fused for a 20-amp start.

General Electric Co., Schenectady 5, N. Y.



Ditching Machine (17)

A new unit has been added to a line of crawler and wheel-mounted ditching machines. For extreme mobility and rugged adaptability to terrain, the unit has a four wheel drive with 45 mph road speed, dependable power. Other features of the ditcher are: fully-enclosed operator's cab, lights, and regular truck steering. Either of two digging booms—one with 5 foot digging depth and other with 3½ foot depth—may be used with the machine. Digging width may be varied between 8½ and 18 inches. Change of dimensions of digging is simply and easily made. Forward speed of unit may be varied between 0 and 13 feet per minute; speed of digging buckets has three different settings. Controls can be fully manipulated from a sitting position in the cab or from the ground alongside the machine.

Barber-Greene Company, 400 North Highland Ave., Aurora, Ill.

Room Conditioners (18)

Three new models have been added to a line of room air conditioners. The new additions include: a reverse cycle model to heat in winter and cool in summer; a model for casement windows; and a 2-hp model for larger area cooling. These new models are finished in Alpine gray in keeping with any contemporary decor. The reverse cycle unit is a 3/4-hp model with a pushbutton control panel on which any one of 10 comfort zones can be selected. Control settings include: full-cool, for maximum comfort on hot days; quiet-cool, for low speed fan during sleeping time; cool-exhaust, for pumping out stale air and maintaining a comfort zone; heat-circulate, for circulation of heated room air; heat-fresh-air-in, for bringing in a supply of warm filtered outside air; and heat-exhaust, for ventilating and heating. The casement unit is also 3/4-hp size.

Westinghouse Electric Appliance Division, 653 Page Blvd., Springfield 2, Mass.



Chicago's Grant Park Underground Garage uses Corning flat and bent Alba-Lite lightingware. Alba-Lite comes in a variety of bends to provide design flexibility. Flat Alba-Lite panels are available in three patterns offering true light source transmission, exceptional brightness control by diffusion, high fixture efficiency, permanence and low upkeep cost.

Owner—Chicago Park District
 Consulting Engineers—Ralph H. Burke, Inc., Chicago, Ill.
 General Contractor—Electrical work installed by White City Electric Company and J. Livingston and Co., under John Griffith & Son Construction Co., all of Chicago, Ill.
 Fixture Manufacturer—Solar Light Manufacturing Company, Chicago, Ill.

Safe, glare-free illumination for world's largest underground garage

No more circling weary blocks looking for a place to park in Chicago's busy Grant Park area.

Now you swing your car off the street down a ramp to the new Grant Park Underground Garage. There's space there for 2359 cars in 787,000 square feet of floor space.

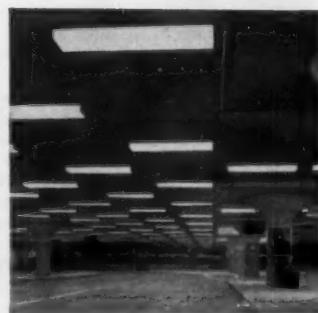
Lighting in this garage, wherein 90% of the cars are self-parkers, must provide for quick adjustment from natural to artificial illumination. "Avenues" must be bright—but free of accident-causing glare and shadows. Walkways must be safe for pedestrians on their way to and from their cars.

High efficiency
 Corning Alba-Lite lightingware was se-

lected because it meets all of the requirements for safe lighting established by the Chicago Park District. Alba-Lite is a translucent opal glass. It transmits 60-65% of the light and diffusely reflects 25-30% for an efficiency of greater than 90%. And Alba-Lite transmits the true color of the light source.

In this area where discoloration of lightingware by exhaust fumes could be an expensive maintenance item, easy-to-clean Alba-Lite again proves a wise choice. Nor will time ever dim Alba-Lite's sparkling appearance.

For additional information about Alba-Lite and other Corning-engineered lightingware—louvering, diffusing, and prismatic—use the form below.



Connected lighting load, approximately 450 KW. Maintained lighting level, main thoroughfares, 22 foot-candles. Maintained lighting levels, distribution center, 30 foot-candles. Average parking area illumination, 10 foot-candles.



CORNING GLASS WORKS
 CORNING, N. Y.

Corning means research in Glass

CORNING GLASS WORKS, Dept. EC-1, Corning, N. Y.

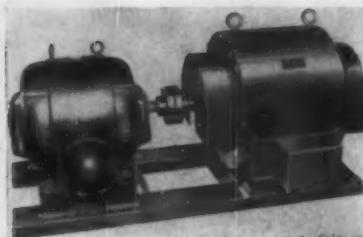
Please send me a copy of the "Architects and Engineers Handbook of Lighting Glassware."

Name..... Title.....

Company.....

Address.....

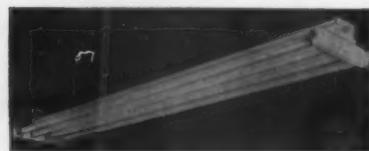
City..... Zone..... State.....



Frequency Changers (19)

High frequency power generator for fluorescent lighting applications. When operating fluorescent lamps on high frequency power it is possible to vary the brilliance of the lamps over a wide range by changing the size of the ballast. The frequency changer consists of an induction motor which drives a 400 cycle alternator. These units are available in ratings from 2 to 50 kw. Dimming of the lamps can be accomplished by switching a smaller capacitor in series with the lamp. Since high frequency fluorescent lighting is flicker-free and stroboscope effect is absent, this new technique should be of interest for many industrial and laboratory applications where lighting requirements are critical.

Bogue Electric Manufacturing Co., 52 Iowa Ave., Paterson 3, N. J.



Lighting Fixtures (20)

A new series of multi-purpose large strip fluorescent lighting fixtures, known as the Suburban line. Available in 2-, 3-, 4-, 6- and 8-lamp units and in 4-, 8- and 16-ft lengths. In addition to their many industrial applications, they can be used in supermarkets, waiting rooms, TV studios, library stacks, corridors, garages, and other areas requiring considerable light. They may be surface-mounted, or pendant-mounted by chain, pipe, messenger cable or with slide grip hangers which fit grooves along the entire length of the chassis. Multiple knockouts are provided for continuous-row wiring. Various types of lamps may be used including rapid start, instant start and T-17. Both 40- and 75-watt lamps may be used. Fixtures bear the U.L. and E.T.L. labels.

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

Control System (21)

A new positive automatic control system with remote transmission has been designed for industrial and municipal water and sewage systems. The equipment consists of a rugged, reliable compact arrangement of sensing and control devices capable of measurements within

one-half of one percent. There are no moving parts or mechanical adjustments required. Units are protected against malfunction, operational loss or power loss by means of a gong and signal light, both of which operate to alert the operator. The overall telemetering system can be used for reliable control of remote pumps, valves, gates, tanks and reservoirs. The equipment first measures, then transmits, then applies control.

Automatic Control Company, 995 University Ave., St. Paul 4, Minn.



Grounded Cord Set (22)

A new shockproof, grounded 3-wire U-blade extension cord set. It has been especially designed to meet the new grounding requirements which went into effect on January 1, 1955, and will accommodate the new 3-wire caps which will be components of many portable tools and appliances. Features include an armored cap and connector with metal cord clamps, and No. 16-3 Type SJ heavy duty wire. Sets are available in lengths of 10, 25, 50 and 100 feet. Rating of Cat. No. 396, is 15 amps, 125 volts. It is Underwriters' listed.

Rodale Manufacturing Co., Inc., Emmaus, Pa.

Generators (23)

Three new electric generating plants built especially for magnet service in scrap yards, large industrial plants and for original equipment manufacturers have been announced. Model 10CW-150R is a remote starting unit with a rating of 40 amps, at 250 volts dc. Prime mover for this new magnet generator is the Onan opposed 2-cylinder, air-cooled "CW" engine which utilizes an exclusive "vacuum cooling" system by which all heated air is expelled at one small vent which also discharges engine exhaust. The magnet service generator (with drooping voltage characteristic) is direct connected to the engine, is of drip-proof design, will deliver 230- to 250-volt output (with rheostat control) and is cooled by the engine blower.

Two new water-cooled engine driven magnet service generating plants are offered in 10,000- and 15,000-watt sizes. Model 10HQ-150R will deliver 40 amps at 250 volts; Model 15HQ-150R rates at 60 amps, 250 volts. Both are remote starting.

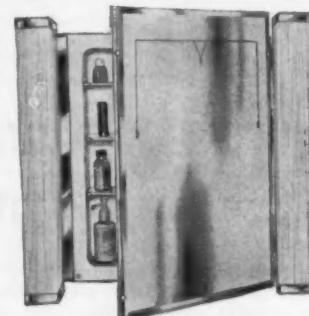
D. W. Onan & Sons, Inc., Minneapolis 14, Minn.



Stud Welding Gun (24)

A new stud welding gun, identified as NS-9, is available with cable and controls in two sizes, one for welding studs with diameters up to $\frac{1}{2}$ -inch and the other for any diameters from 10-gauge to 1-inch and greater. The new design accommodates a greater range of stud length without changing adapters or other accessories. The arc length can be adjusted without disassembly, and a new coil design offers greater lifting power and improved efficiency. The gun has a swept-back handle through which the cables enter a steel barrel that extends through the plastic gun body. Reduction in the number of electrical connections from 3 to 1 has made for increased operating efficiency and simplified maintenance.

Nelson Stud Welding Division, Gregory Industries, Inc., Lorain, Ohio.



Bathroom Cabinets (25)

Instant start fluorescent lighting and newly designed shielded fixture light are featured in the new line of Packard wall cabinets. Cabinets mount twin shielded fluorescent tubes that illuminate instantly. When cabinet door is opened, an interior light is automatically turned on. Cabinets are available in three sizes: 13 $\frac{1}{2}$ by 19 $\frac{1}{2}$ with a 16 by 22 mirror with two 15-watt fluorescent lights; 15 by 21, 18 by 24 mirror, with two 20-watt lights and 17 by 27, 20 by 30 mirror with two 20-watt lights.

Packard Cabinet Division, Winton Manufacturing Co., 3350 N. Crawford Ave., Chicago 41, Ill.

**WESTINGHOUSE
DISTRIBUTOR REPORT**



Here's how you can show management ways to cut costs now

Now's the time, all right . . . time you can turn a "breather" into a real opportunity.

Breather? We mean the more normal production schedules today, compared with the frantic, all-out pace followed over the past few years.

And you can use it to advantage.

You can show management how it enables them to make badly needed change-overs, with less interference to operations than before. You can show

how lighter machine schedules and less crowded shop conditions mean that partial shutdowns for replacement can be made more easily, more economically.

And you can show how modern electrical equipment means better, lower cost production *today* . . . when costs are really tight.

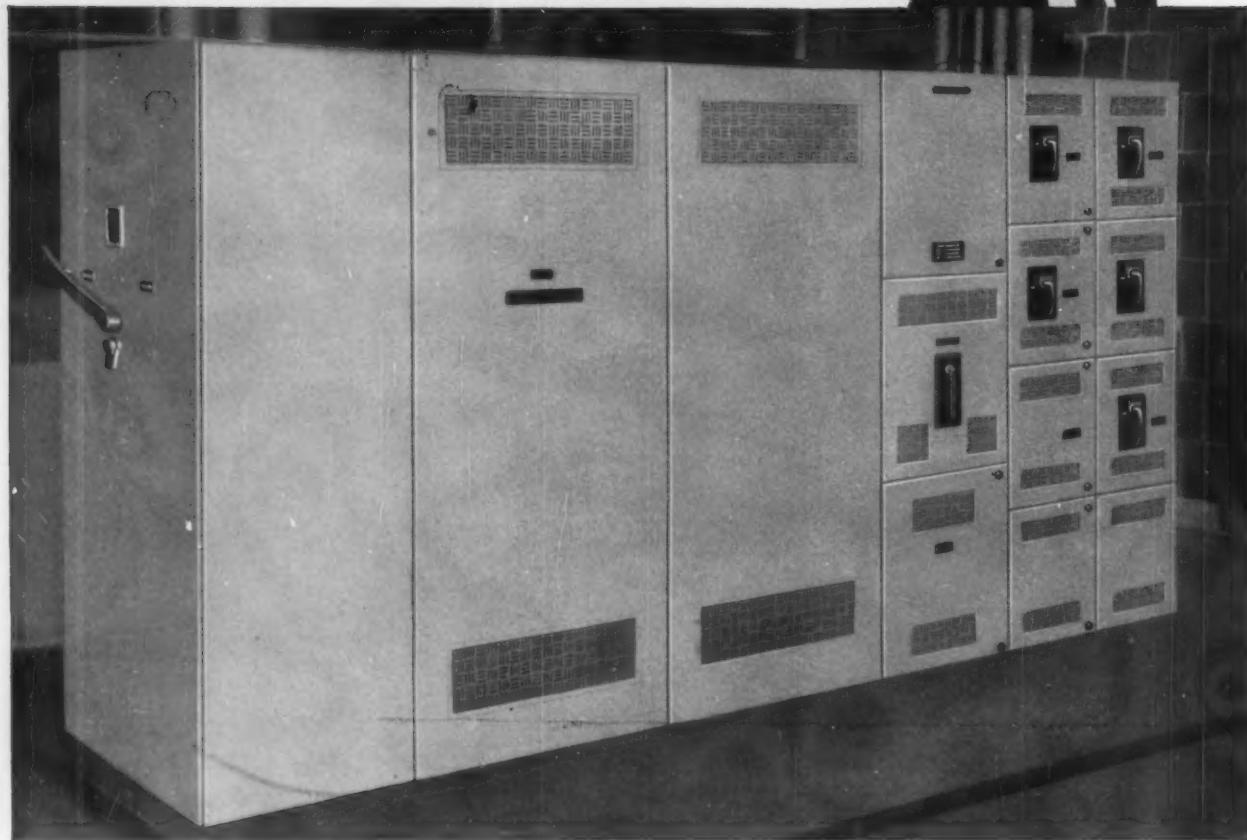
DP-5009-A

The next seven pages help you show why . . .

**YOU CAN BE SURE...IF IT'S
Westinghouse**



Point out the advantages of high-voltage distribution . . . and you'll show management how to get more productive output today.



Carry high voltage close to loads with dry-type power centers

Long, low-voltage feeders—a costly practice still followed by many plants—can be eliminated with Westinghouse dry-type power centers.

Combining transformers and circuit protecting equipment in a single enclosure, they permit high voltage to be carried close to the center of the load. Result: reduced line losses; improved voltage conditions—lowering operating costs and stepping up efficiency of motor drives and plant lighting.

Further, Westinghouse dry-type power centers eliminate the need for separate vaults . . . the expense of storing or replacing oil. And they are inherently flexible. New feeders can be added easily as power requirements grow.

DP-5009-B

And the features of Westinghouse bus duct mean this to management: flexibility today to easily handle production line changes tomorrow . . .

YOU CAN BE SURE...IF IT'S



Flexibility of plug-in bus duct solves changing load requirements

The frequent rearrangements and additions modern industry makes in its production lines are readily handled with Westinghouse plug-in bus duct.

By providing power availability at one-foot intervals, it enables relocated or new machines to be tied-in quickly, with a minimum loss of production time. And power take-offs are easy. Merely slide cover away from plug-in receptacle.

Then, plug in and fasten unit to duct.

Westinghouse plug-in bus duct is prefabricated. It installs easily with cantilever or "C" clamp hangers, adapts to any layout and is completely salvageable . . . can be dismantled, reassembled, expanded.

Comes in four types to meet any distribution need. Also available with aluminum bus bars.

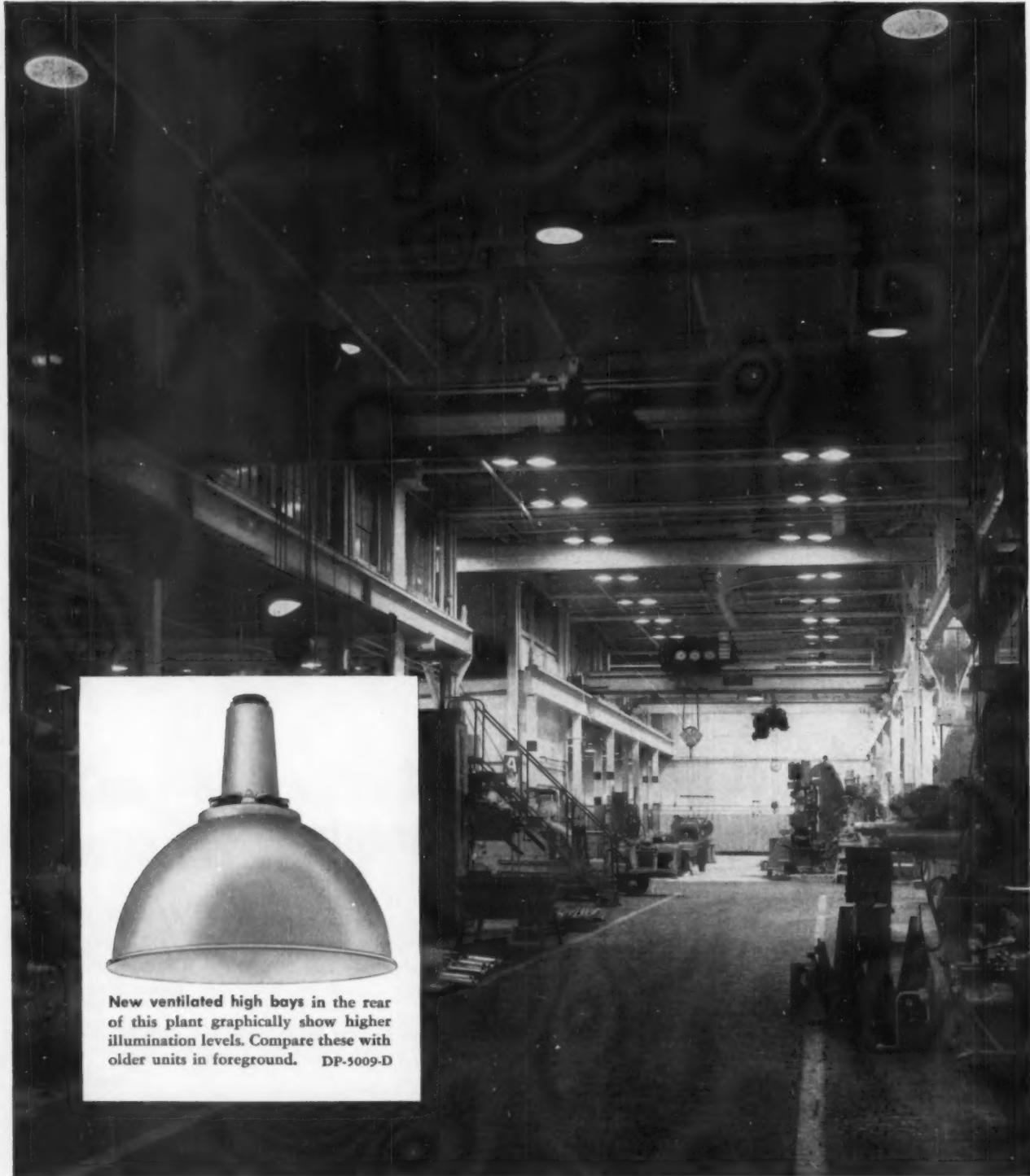
DP-5009-C

Westinghouse





*Spell out better seeing conditions through
planned lighting . . . and you'll show how
to maintain better quality control now.*



New ventilated high bays in the rear of this plant graphically show higher illumination levels. Compare these with older units in foreground. DP-5009-D

Ventilated mercury high-bay fixtures mean more light, less maintenance

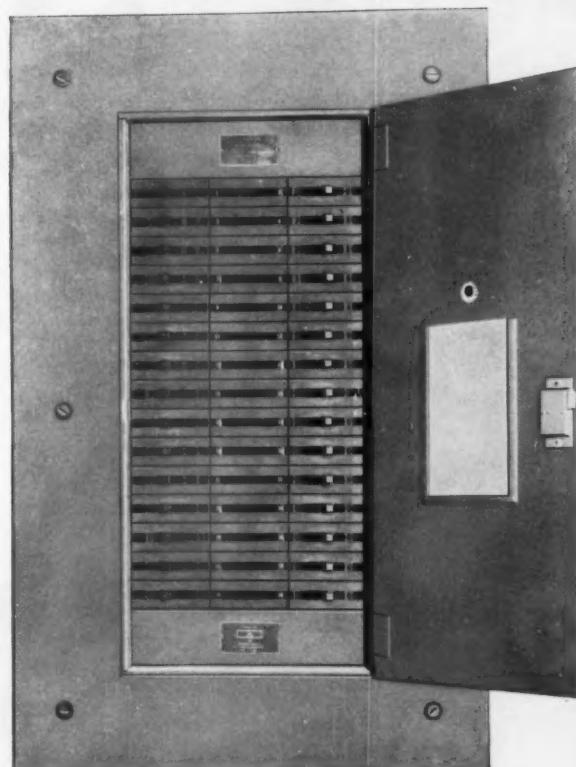
Mercury lighting and Westinghouse ventilated high-bay fixtures bring these immediate benefits to the production area: increased illumination and lower maintenance costs.

The Westinghouse high-bay fixtures have an opening between the neck and reflector. This provides a constant air stream that sweeps the entire reflector surface clean. Less manual cleaning is needed; lighting efficiency

is maintained over a longer period—extremely practical advantages when over-all economy is considered.

In addition, these new ventilated high-bay luminaires last longer since the reflector and extension neck are separately spun pieces. The ventilating system is not a part of the extension or reflector. This means *no weak spots*. There's no punching of holes to weaken the structure in critical areas. This means *longer life*.

Protect modern lighting installations with circuit breaker panelboards



A single lighting outage adds up to a double cost. There's the labor and materials cost—necessary to restore service. And there's the cost of production down time—the loss of man and machine hours.

Both can be virtually eliminated with Westinghouse circuit breaker panelboards. Their AB "De-ion®" circuit breakers won't trip on harmless overloads . . . yet, permit quick restoration of service when circuit interruptions occur. A flip of the breaker handle restores service instantly and safely. No need to call a maintenance man or electrician. No fuses to store. No chance of over or under fusing.

DP-5009-E

Type NH1B Lighting Panelboard—for 277/480-volt, 3-phase, 4-wire lighting circuits. Made up of "E" frame breakers. "De-ion" arc extinction plus thermal and magnetic tripping devices gives maximum protection.

YOU CAN BE SURE...IF IT'S
Westinghouse



Cover off the importance of backing production equipment with modern drives... and you'll show how to bring about immediate operating economies.

Meet demand for operating economy with better protected Life-Line "A" motors

The drives *behind* production equipment can spell the difference between reasonable and excessive operating costs. That's why the new Westinghouse Life-Line® "A" motor is a basic consideration.

Here's a power package guaranteeing better performance... a better protected motor that's smaller, yet stronger and electrically longer lasting than *any* conventional motor on the market today. Here are the advantages found only in Life-Line "A":

1. **New 4-way seal, pre-lubricated bearing.** Needs no lubrication; protects against under or over greasing and entry of foreign matter... resulting in longer motor life.
2. **New Bondar conductor insulation.** Means more resistance to heat and contaminants... longer motor life.
3. **New Bondite stator insulation.** An impregnating varnish fortified with silicone which resists water, vapor and chemical fumes. This means dependable operation under any atmospheric conditions.
4. **New Mylar® slot insulation.** Greater dielectric and mechanical strength which means fewer motor failures. DP-5009-F

*Du Pont registered trade-mark.





Modern circuit protective devices assure better production efficiency

Lost production time. Heavy maintenance costs. You'll cut these by recommending modern circuit protective devices shown here. Have management consider:

AB-1 Circuit Breakers. They provide complete protection against short circuits and high overloads . . . literally paying for themselves in many cases by eliminating unnecessary down time.

The Westinghouse "De-ion" circuit breaker measures both time and current . . . trips only on dangerous overloads that could damage production equipment. And when power is interrupted, service is restored quickly and safely. A flip of the circuit breaker handle does it.

There are no fuses to replace, nothing to wear out, practically no maintenance of any kind.

Safety Switches. A complete, high-quality line to meet your requirements when management requests fusible protective devices. The new Type "H", for example, is now ready for heavy-duty industrial applications.

It provides a NEMA-1A dust-resisting enclosure with an interlocked cover that cannot be opened when switch is in the "ON" position. Too, line terminals are covered by a Micarta® shield—minimizing exposure to live parts when inspections or fuse replacements are made.

DP-5009-G

YOU CAN BE SURE...IF IT'S
Westinghouse





A one-stop apparatus source for your modernization needs

The Westinghouse distributor in your locality is equipped to serve all your apparatus requirements.

From centrally located warehouses he can supply, complete from stock, full product lines—matched Westinghouse equipment recognized for their simplified and standardized design. This means easier installations . . . gets you on and off the job quickly.

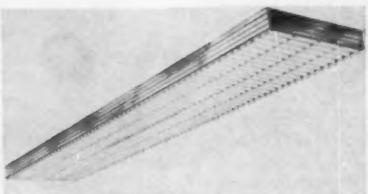
Additionally, the Westinghouse distributor in your area offers you the services of Westinghouse headquar-

ters engineers . . . product and application specialists who are closely identified with the construction industry. Operating on a team basis, they are readily available . . . when and where you need them . . . to help you handle many of your electrical problems.

One call to your Westinghouse distributor puts this combination of product and engineering services to work for you. Get in touch with him for a survey of your electrical needs.

DP-5009-H

YOU CAN BE **SURE**...IF IT'S **Westinghouse** 

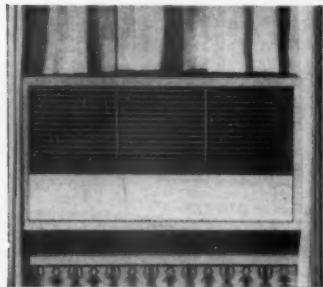


Lighting Fixture

(26)

The lighting fixture, known as Louverlite, for use in stores, offices and schools, has been redesigned. It is approximately 3 inches in depth and is available in 4- and 8-ft units for two or four T-12 430-MA lamps. Available with steel or translucent plastic side inserts and for two or four Rapid Start Bi-Pin. While the Louverlite is totally direct in light distribution—100% downlighting—there are removable sections in the top reflector if varied up-lighting effects are desired. Louvers provide a shielding of 25° crosswise by 40° lengthwise. The Louverlite slimline can be mounted individually or in continuous rows, and may be surface or pendant mounted. Louvers are hinged from either side and may be completely removed without the use of tools. Ballast, concealed in the V-section of the louver, is accessible by opening louver.

Smithcraft Lighting Division, Chelsea 50, Mass.



Air Conditioner

(27)

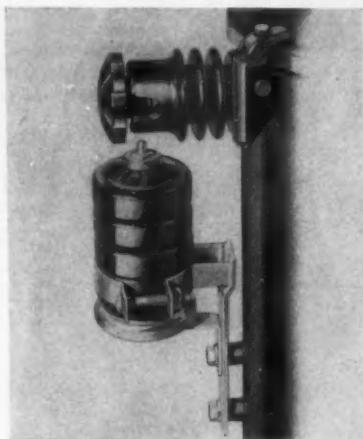
A new air conditioning unit which can be adjusted to fit flush with the inside wall—and not bulge out into the room—is featured in G.E.'s new 1955 line of room air conditioners. The line features cabinets in blond and mahogany finishes, improved appearance in both interior and exterior cabinets, and units which can heat as well as cool.

The flush mount construction, known as Drape-Line design, is available in the R32M, R52M and R72M models, including $\frac{1}{2}$ -hp, 115-volt and $\frac{3}{4}$ -hp, 115-, 208- and 230-volt models and in 1-hp, 208- and 230-volt models. They can be installed flush with the inside wall or project into the room. Cooling capacity is not lowered in any way by the flush position. If the projecting position is preferred, the flat top of the unit, which does not house any controls, may be used as a shelf. A panel covers the two control knobs at base of cabinet front to blend into front design. Three rotator air directors provide flexible and draft-free air direction. Located behind the front grille, the three directors

adjust independently with a finger touch.

"All-weather" units, which heat as well as cool, are available in the $\frac{3}{4}$ -hp and 1-hp 230-volt models. Since the reverse cycle is effective only when outside air is above 40°F, a resistance heating element has been added that turns on automatically when outside air temperature drops below that point.

General Electric Co., Appliance Park, Louisville, Ky.



Arresters

(28)

New open gap valve arrestors for side or cover mounting on RWP distribution transformers, designated Type T. They feature low impulse sparkover, low IR drop, limiting of 60-cycle follow current, and positive interruption of follow current. Type T arresters are available in ratings of 10 kv for cover mounting applications and 3 and 6 kv for sidewall mounting applications. Each arrester consists of a series gap and valve element encased in porcelain. An external open gap is achieved by locating the arrester's external electrode a prescribed distance from a line terminal. A ground terminal is provided for easy connection to the transformer tank for interconnection with system and secondary neutrals.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.

Armor Cable

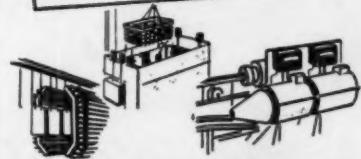
(29)

A new varnished-cambric interlocked armor cable with a polyvinyl chloride covering over the armor for use in pulp and paper mills, chemical plants, and other installations where corrosive conditions are a problem. The new plastic over-all jacket is highly resistant to the action of acids, alkalies, grease, oil and moisture. The smooth and flexible covering conforms closely to the armor and permits the cable to be pulled easily. In addition, this plastic covering will not support combustion and will not oxidize or deteriorate when exposed to sunlight and weather. Available in black, red, yellow, blue, green, and white for easy circuit voltage identification.

General Electric Co., Bridgeport 2, Conn.

WHY CHROMALOX OFFERS YOU

THE MOST IN ELECTRIC HEAT



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Thirty-seven years devoted exclusively to the design, manufacture and application of Chromalox electric heating units for process heat up to 1100°F.



OVER 15,000 TYPES SIZES AND RATINGS

The dependable Chromalox line of over 15,000 standard types, sizes and ratings assures you an exact heating tool for each heating job. Immediate shipment on most standard heaters.



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Experienced Chromalox heating engineers in principal cities can give you prompt, competent field assistance and consultation. They will help you with ordinary and unusual heating problems.

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CHROMALOX CATALOG 50

It's jam packed with useful data on the applications of Chromalox Electric Heaters.



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 Have a Chromalox Application Engineer get in touch with me.

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City _____ Zone _____
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ELECTRIC HEAT
FOR MODERN INDUSTRY



ONLY ONE SETUP IS NEEDED!

PUSHES 45 Ft. of fish tape per min.
PUSHES around five 90° bends.
STOPS automatically if obstructed.
PUSHES 175 Ft. of .060" x 1/4" usable highest

quality tape.

MAY BE USED in any position.

INDICATOR shows how many feet of tape is pushed into conduit.

★ ★ ★

PULLS 17 Ft. per minute, full load.
PULLS 1200 Lbs. (equals pull of 8 men).
PULLS wire in 3/4" to 2" conduit.
OPERATES on 115 Volt AC or DC Current.
RUGGED, Heavy Duty Construction.

★ ★ ★

SAFE! The fish tape is always in the conduit or in the tool . . . never free to come in contact with moving machinery, bus bars, live wires, etc.

AVAILABLE THRU YOUR NEAREST

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Greybar Electric Co.
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The **BARTH**
CORPORATION
12652 BROOKPARK RD., CLEVELAND 29, O.

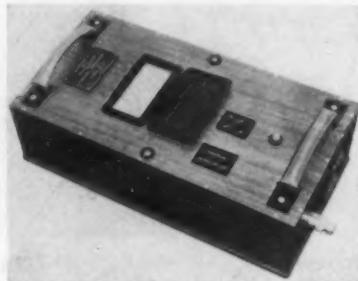


Cables

(30)

Two new service entrance cables, Type SE Style U and Type SE Style A, with heat-resistant insulation, increased current-carrying capacity, have been announced. The 75 C copper temperature of these new service entrance cables provides larger current-carrying capacity than formerly in the same size cable. The new special aluminum paint finish gives cables bright appearance.

General Electric Co., Bridgeport 2, Conn.

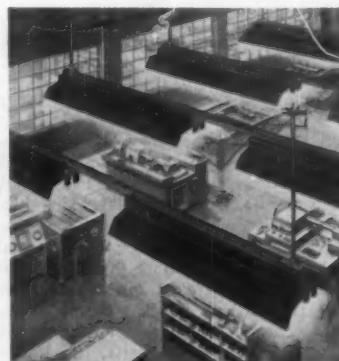


Insulation Testers

(31)

Two new models of Megger insulation testers are now available in rectifier-operated units: one having a range up to 100,000 megohms at 5000 volts dc with 1000-volt and 2500-volt intermediate ranges, and one having a range up to 200,000 megohms at 10,000 volts with no intermediate voltage ranges. These high ranges are useful in field tests on bushings, generators, transformers and cables. Bulletin 21-206 is available.

James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.



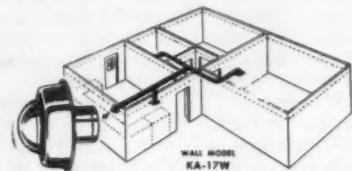
Raceway Fixture Support

(32)

A new combination surface raceway and flush-mounting fluorescent fixture support. This heavy 1 1/2-in. by 1 1/2-in. 12 gauge steel channel was specially designed to provide a complete enclosure for the wir-

ing. It mounts in the "slot-up" position for easy wiring—with 1/2-in. knockouts on 6-in. centers for wiring access to the lighting fixture. Fixtures are flush-mounted to face of channel by means of a 1/2-in. chase nipple, locknut and bushing (or a special stud nut) inserted through the knockout hole. Special conduit-to-channel swing connectors pivot freely to compensate for expansion or contraction in the fixture hanging support by Underwriters' Laboratories, Inc.

Steel City Electric Co., Pittsburgh 33, Pa.

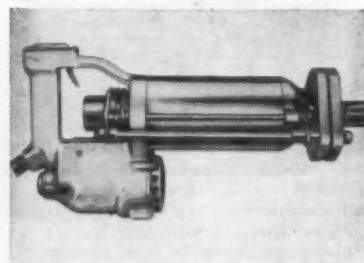


Wall Fan

(33)

A new multiple-vent wall fan pulls from 1, 2 or 3 intakes. It removes moisture, odors, grease, smoke from kitchen, bathroom, gameroom—utility room, extra bath, basement—kitchen range, charcoal grille, wall oven—or any other desired combination of up to 3 intakes. All-aluminum, weatherproof fan unit mounts on wall outside home and connects to interior grilles with standard 7-in. round ductwork. A 7 1/8-in. grille opening is required in wall or ceiling. It is ideal for remodeling as well as new construction. 800 CFM capacity. 3-speed operation. Sealed motor and fan unit. Self-cleaning blades.

Stewart Industries, Inc., 318-X East St. Joseph St., Indianapolis 2, Ind.



Hammer Drills

(34)

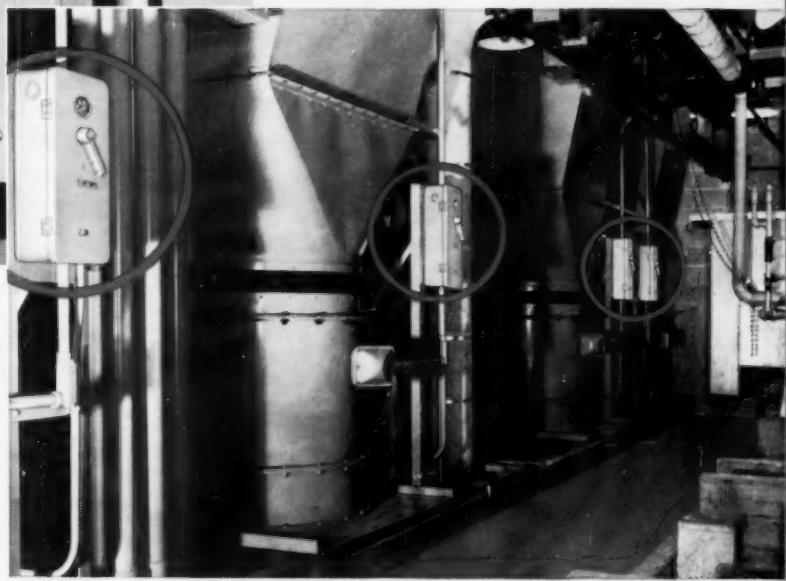
Model 27-RO with a maximum drilling capacity of 3-in. diameter holes has been added to this line of electromagnetic hammer drills. It is designed to speed up quantity hole drilling in concrete and masonry. The hammer drill features automatic rotation of the drill bit. This automatic rotation is accomplished by a rubber ratchet mechanism, which utilizes the recoil of each blow of the hammer piston to slightly turn the bit. Thus the 3600 blows per minute, from 60 cycle current, of the hammer piston rotates the bit with suitable torque at the right speed. Literature is available.

Syntron Company, Homer City, Pa.



A neat, compact line-up of Allen-Bradley Bulletin 712 combination starters in the control room of a large chemical processing plant. Starters can be padlocked in "OFF" position.

A row of Allen-Bradley Bulletin 712 combination starters in metal finishing plant. Note the simplified wiring which is possible when disconnect unit is in same enclosure with starter.



ALLEN-BRADLEY COMBINATION STARTERS

*Save wiring costs
Save Space*

Assure safer and neater motor controls



The
OLD
Way

Separate disconnect mounted above and wired to motor starter. Difficult to do a neat appearing wiring job.

The
MODERN
Way

Bulletin 712 combination starter with disconnect. Cannot be opened unless disconnect lever is "OFF."

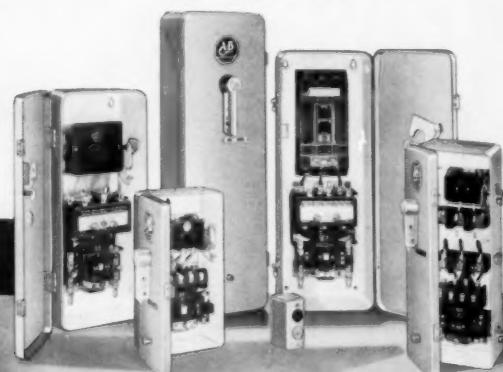
STREAMLINE your MOTOR CONTROLS

by using A-B Combination Starters

The Allen-Bradley line of combination starters is available in two general types—Bulletin 712 with manual disconnect switch and Bulletin 713 with automatic I-T-E circuit breaker. In addition to the standard NEMA Type 1 pressed steel enclosure, these combination starters are furnished in watertight, dust-tight, and semidust-tight enclosures, as well as in enclosures for hazardous gas and dust locations. For complete information, please write for the Allen-Bradley 120-page Handy Catalog.

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

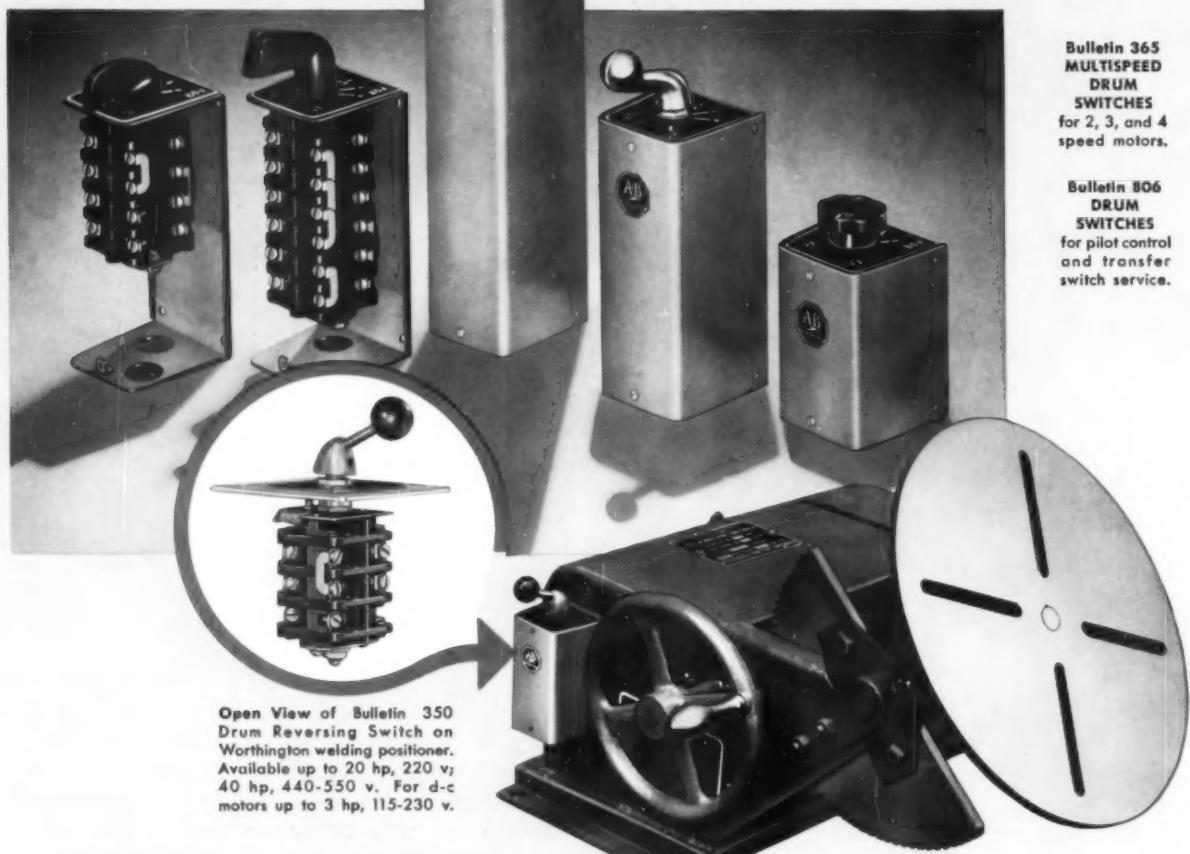
In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario



ALLEN-BRADLEY
COMBINATION STARTERS
QUALITY

Allen-Bradley Combination Starters

DRUM SWITCHES



Open View of Bulletin 350 Drum Reversing Switch on Worthington welding positioner. Available up to 20 hp, 220 v; 40 hp, 440-550 v. For d-c motors up to 3 hp, 115-230 v.

MANUAL CONTROLS

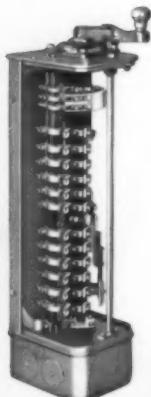
for Alternating & Direct Current Motors

There are many types of motor-driven machines for which a simple drum switch is the most suitable type of manual control. For such applications the Allen-Bradley line offers a wide variety of types and sizes of drum controllers up to 300 hp, 220 v; 500 hp, 440-550 v.

Practically any combination of switching operations can be arranged by the proper combination of drum segments and contact fingers. For complete information on Allen-Bradley drum controllers, send for the 120-page Allen-Bradley Handy Catalog.

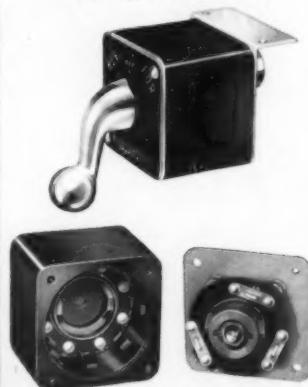
Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario



Bulletin 375-385
DRUM
SWITCHES
for polyphase,
wound rotor in-
duction motors.

Bulletin 350 Low Cost
STYLE A DRUM SWITCHES
for polyphase motors up to 1½ hp,
110 v; 2 hp, 220-440-550 v.



For Single Phase Motors
up to 1 hp, 110 v; 1½ hp, 220 v.
D-C motors—1/4 hp, 110-220 v.





Switch (35)

A 100-amp circuit breaker safety switch designed for service on 120/240 volts ac, in 2- or 3-wire installations. It incorporates two single-pole hydraulic-magnetic circuit breakers with handle extensions attached to form one double-pole unit, allowing both circuit breakers to be switched on or off together. Unit employs general purpose type circuit breakers in standard ratings of 70 or 100 amps. Service is restored with the flip of the switch. Minimum and instantaneous trip points are unaffected by heat or cold.

Heinemann Electric Co., 413 Plum St., Trenton 2, N. J.



Instrument (36)

New Model 770-A volt-ohm-milliammeter, is pocket size and has "full-view" scale. Built around an 850 microampere, D'Arsonval meter, of 2% accuracy, the unit is housed in a 3½-in. by 5¾-in. by 2½-in. bakelite case. It has six ac voltage ranges: 0-15/30/150/300/1500/3000 volts, six dc voltage ranges: 0-7.5/15/75/150/750/1500 volts, two resistance ranges: 0-0.1/1 megohm, three dc current ranges: 0-15/150/1500 milliamperes, and three decibel ranges: -6 to plus 18, plus 14 to plus 38, and plus 34 to plus 58.

Superior Instruments Company, 2435 White Plains Road, New York 67, N. Y.



Conforms to the standards
of the Electrical Service
Connector Institute

DOSSON "F" SPLIT BOLT CONNECTOR

Fabricated from high strength alloys (better than average steels), the Dosson "F" is cold-formed for uniform quality. Maximum contact pressure is assured by a high translation of tightening torque. Full length pressure bars with rounded edges prevent load concentration and crushing of conductor. Built to withstand high overload, vibration. Highly corrosion resistant.

**Mail coupon for FREE
Dosson "F" Connector**



DOSSERT MFG. CORP.
249 Huron St., Brooklyn 22, N. Y.

Gentlemen:

Please rush free sample Dosson "F" Split Bolt Connector plus catalog sheet.

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Address _____ Zone _____ State _____

City _____



DOSSERT MFG. CORP.

249 Huron St., Brooklyn 22, N. Y.



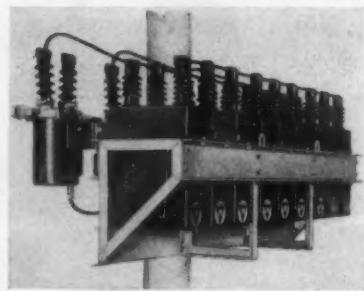
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do most users
prefer and buy the genuine
RIDGID
PIPE WRENCH?

It's easiest to work with... perfect balance... comfort-grip I-beam handle... handy conduit scale on hookjaw... easy-spinning adjusting nut... clean grip on conduit, no slip or lock.

It lasts longer... first guaranteed housing, won't break or bind... ever. Every wrench individually tested before shipment... and millions of them in use. Sizes 6" to 60"—end pattern, 6" to 36".

For the most for your money, buy **RIDGID**... Your local Supply House stocks them for you, delivers them fast!

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.



Capacitor Racks

(37)

Single-row capacitor racks designed for direct pole mounting. They are available as complete assemblies, switched or unswitched, and ready for immediate field installation on distribution systems rated 2400 to 13800 volts. Bank sizes may be 225 or 300 kvar. Mounting positions for NR switches are changeable to meet various primary circuit configurations, and a junction box provides a single connection point for control wiring. Other features include coordinated bird proofing, disconnect plug on NR switches, and a lifting yoke.

Line Material Company, 700 W. Michigan St., Milwaukee 1, Wis.

Wire

(38)

Two additional sizes of GE Geotrol gasoline- and oil-resistant wire, No. 8 and No. 6 Awg, have been announced. The addition of these two sizes of Underwriters' Laboratories listed Geotrol wire increases the range of wiring for which this gasoline- and oil-resistant wire, which needs no lead covering, is available and will make for greater economies in wiring gasoline pump islands, bulk plants, oil refineries, and the like.

General Electric Co., Bridgeport 2, Conn.

Recessed Troffers

(39)

The trend to large area lighting and the wide use of grid ceilings has led to the development of a line of 24-inch wide troffers. The new dimensions—2 ft. by 2 ft., 2 ft. by 4 ft., and 2 ft. by 8 ft.—cover a line of troffers designed for use in U. S. Gypsum's Z-Spline, Cupples Alumi-Coustic ceiling and also for plaster ceilings. Units have concealed hinge shielding by Gratelite louver-diffuser, and are available for 2, 3, 4 or 6 lamps, 20-, 40- or 75-watt operation. Units can be installed singly, in continuous rows or in other lighting patterns.

The Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3, Mo.

Receptacles

(40)

A new line of dryer receptacles and cords. Featuring the "L" shaped grounding slot and blade these 2 connections are usable on all 30-amp dryers and are interchangeable with other standard makes.

Dryer receptacle, Cat. No. 125, is available in either black or ivory bakelite housing with "L" shaped grounding slot, polarized. Combination $\frac{3}{4}$ -in. and 1-in. knockouts are in bottom and back with an easy-to-get-at cable clamp. Dryer cord, Cat. No. 130, has an "L" shaped grounding blade in a bakelite head. It is 4 ft. long with 3 No. 10 leads, with integral copper lugs and strain relief clamp. Both receptacle and cord are rated at 30-amp, 250 volts and are listed by Underwriters' Laboratories. Besides dryers these two new devices can be used on equipment such as welding machines and large motors which use 30-amp cords and receptacles.

Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza South, Long Island City 1, N. Y.

Wiring Tool (41)

Design of an all-purpose electrician's wiring tool has been improved to increase its usefulness. In addition to its use in cutting, stripping and twisting solid or stranded wire and installing Nycaps on pigtail splices, the tool can now also be used to install solderless terminals. The tool offers an exclusive Tri-Dent crimping action for use on wire terminations, assuring connections of high mechanical and electrical strength, with controlled deformation of the wire but without reduction of the cross sectional area.

Buck Electrical Mfg. Co., P. O. Box 147-30, Roselle, N. J.



Tool (42)

A new rotary electric Impactool, known as the Size 5U, has a $\frac{1}{2}$ -in. drive and weighs $6\frac{1}{4}$ lbs. Although developed primarily for automatic use, the 5 U has application wherever fastening must be applied or removed. It is a multi-purpose tool. With standard attachments which can be easily and quickly applied, it will drill, drive screws, ream, tap, do wire brushing, hole sawing, etc. It features a renewable, synthetic rubber bumper which snaps onto the front of the tool housing. This prevents the entrance of dirt around the driver and also protects the housing when the tool is used in tight spots. It operates on 110 or 220 volts, ac-dc, 60 cycles or under.

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.



For Grounding
Exposed Metal Parts
of Portable
Electrical
Equipment

NEW 3-WIRE CONVENIENCE OUTLET

It's **Rugged**

FEATURES

- Large-head binding screws for conventional wiring
- Break-off feature for two-circuit installations
- Hexagonal green screw for grounding wire
- Will accommodate two armored or rubber caps
- Slots for 2-wire regular and polarized caps
- U-shaped slot for ground blades
- Washer-type plaster ears
- Wire looping slot

A competitive, yet highly dependable, duplex flush-mounting receptacle for all practical applications — another example of Hubbell's ability to provide the best in design, materials, and performance even when price is an important consideration. Side-wired with grounding terminal and parallel slots, in brown bakelite and ivorine. Write for full details on its rugged dependability, or see your Hubbell distributor.



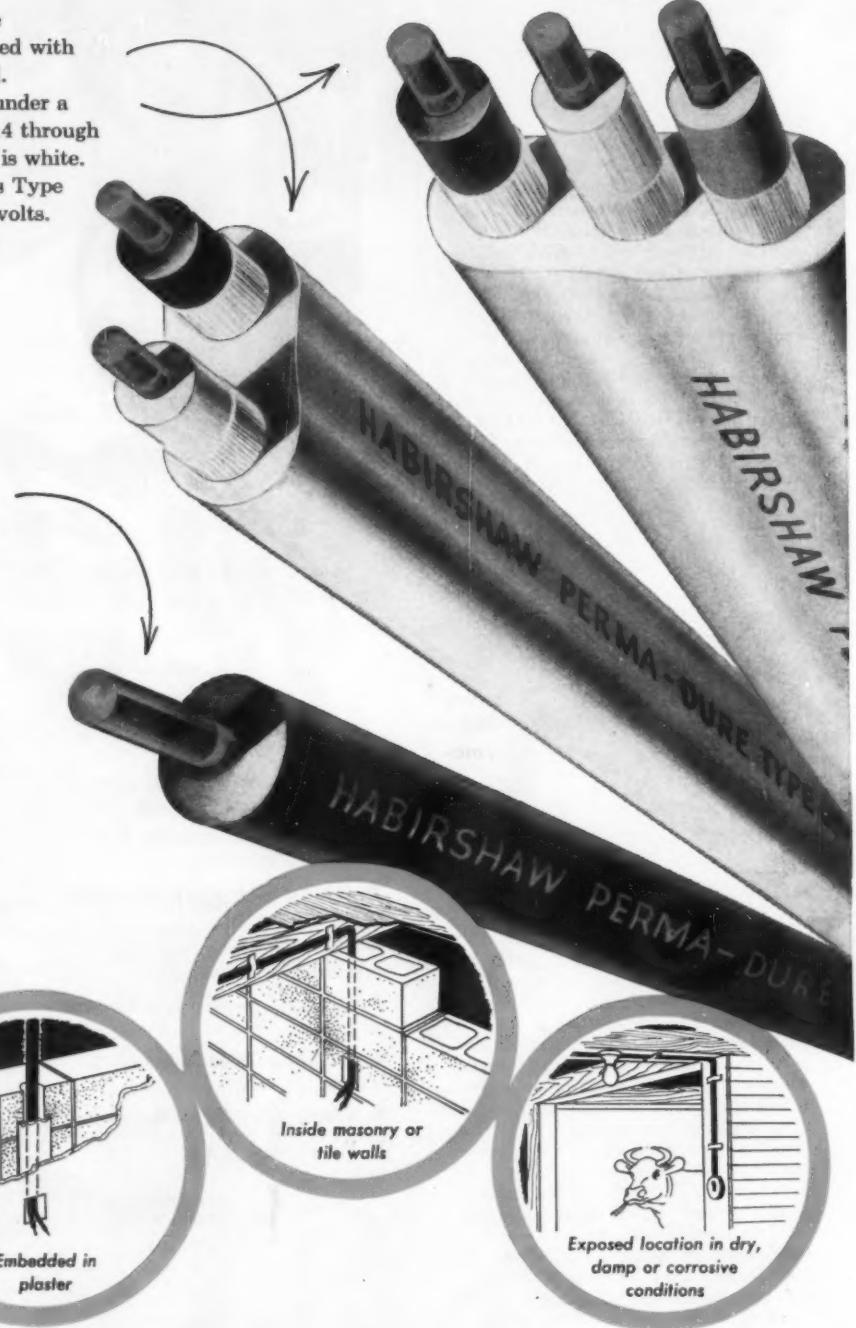
HARVEY HUBBELL, INC.
Write Dept. C-1
BRIDGEPORT

CONNECTICUT

Phelps Dodge

PERMA-DURE two or three conductor cable is insulated with Habidure, glass wrapped. Conductors laid parallel under a Habidure sheath. Sizes 14 through 10 AWG. Standard color is white. Underwriters approved as Type UF and Type NMC-600 volts.

PERMA-DURE single conductor is insulated with Habidure (thermoplastic). Sizes 14 through 8 AWG (solid) and 6 through 4 AWG (seven strand). Standard color is black. Underwriters approved as Type UF-600 volts.



Multi-
purpose

Perma-Dure!

An Economical, Dependable Cable for

- Underground Wiring Including Direct Burial
- Interior Wiring

PERMA-DURE, a Phelps Dodge product, provides electrical contractors with a durable, versatile type of flame-resistant cable for industrial and commercial use.

PERMA-DURE handles easily, strips readily and helps cut installation time and costs. It is supplied in single, two and three conductors for feeder or branch circuits. Under the 1953 National Electrical Code, *Perma-Dure* is recognized for installations as follows:

TYPE UF, single and multiple conductor, as feeder or branch circuit cable, for direct burial in the earth when provided with over-current protection.

TYPE NMC, multiple conductor (moisture and corrosion resistant non-metallic sheathed cable) for installation in exposed or concealed locations, in dry, damp or corrosive conditions; inside masonry or tile walls; or embedded, when suitably protected, in plaster and shallow chase in masonry.

See Your Phelps Dodge Distributor

PHELPS DODGE COPPER PRODUCTS
CORPORATION



NOW! PROPELLER FAN ECONOMY for MANY OF YOUR BIG AIR JOBS!



96" "BUFFALO" PACKAGE FAN
DELIVERS 80,000 cfm AT $\frac{1}{4}$ S.P.
REQUIRING ONLY 15 H.P. MOTOR!

Recently delivered for ventilation of a midwest power plant, this giant "Buffalo" Heavy-Duty Package Propeller Fan is inexpensively wall-mounted. Its husky eight-foot belt-driven wheel exhausts a volume of air which formerly required a more costly fan. Just an example of how the new, expanded line of "Buffalo" Propeller Fans (package units complete with drive now available in capacities up to 250,000 cfm!) can do more and more jobs for you, better than ever before. Write today for catalogs!

BUFFALO FORGE COMPANY

520 Broadway

Buffalo, New York

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

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PANEL BREEZO FANS
BREEZ-AIR ATTIC FANS

BELTED VENT SETS
"L" BREEZO FANS



BELT-AIR FANS
"NV" BREEZO FANS



Instrument

(43)

A new volt-ohm-milliammeter with a combination of functional ranges that cover a variety of electronic test measurement applications. Known as Model 980, instrument has a dc sensitivity of 20,000 ohms/volt and an ac sensitivity of 1,000 ohms/volt. Accuracy is 2% dc and 3% ac. Range and functional switching is simplified by use of a single dial for all ranges and functions. Overall size is 6 1/4-in. by 7 1/2-in. by 3 1/4-in. Weight is two pounds and scale length is 4.63 inches. Literature is available.

Weston Electrical Instrument Corp., Newark, N. J.

Thermostat

(44)

A special thermostat has been developed for use with electric resistance heating. Unit maintains the necessary uniformity between air and surface temperatures which is necessary with radiant heating systems. Utilizing a hydraulic action element, the Comfort-Ease thermostat features a cup and diaphragm exposed to the air and to radiant effects of panel heat. Highly sensitive, the thermostat maintains balance between air and surface temperatures, allowing one to drop as the other increases, thus maintaining uniform comfort rather than uniform air temperature. The unit is not affected by altitude, humidity or other local conditions. Switch design and sensitivity of the element give an operating air temperature differential of not more than $\frac{1}{2}$ °F. The unit is regulation size, fitting a standard wall outlet box.

Sunwarm, Inc., Kingsport, Tenn.

Rotary Hammer

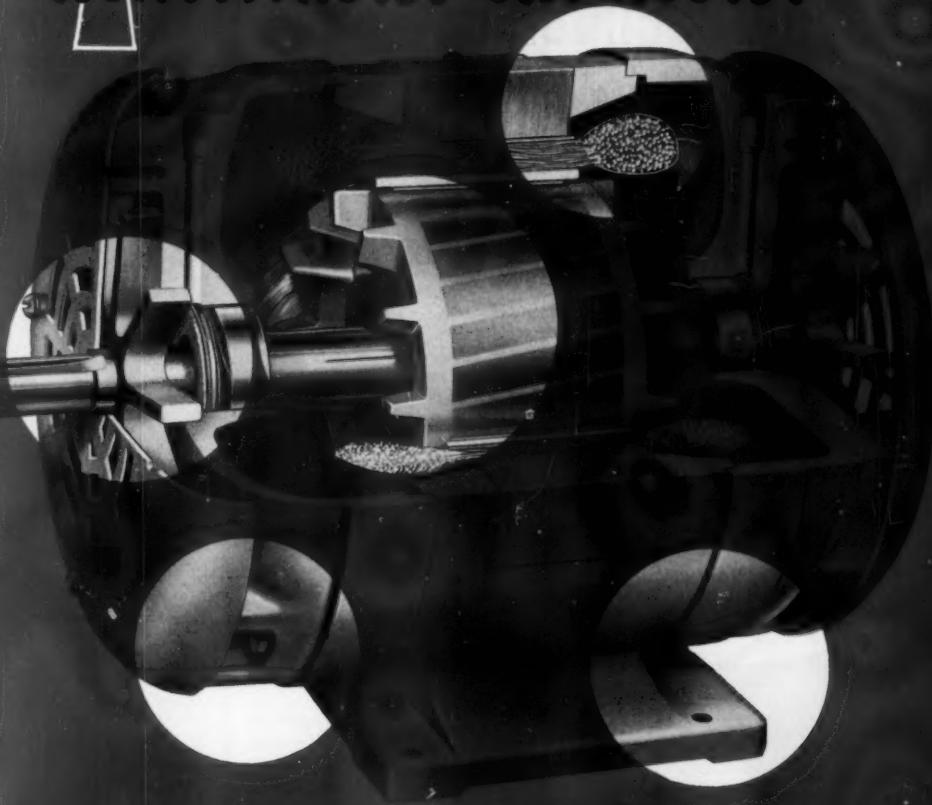
(45)

A new, light weight, portable rotary hammer has been developed for drilling holes up to 4 feet in a variety of materials. Weighing 9 1/2 pounds, the 15-inch drill requires only light pressure to operate, making it particularly useful for overhead or ceiling drilling in concrete. Reduced noise level allows drilling even in residential areas. The one-man tool is powered by a 115-volt, ac or dc, 5-amp, 60-cycles or less, motor. No transformer or rectifier is required. With a versatile carbide-tipped bit, the tool will drill self-cleaning holes from $\frac{1}{8}$ -inch to 1 1/2-inches in diameter in stones, rock, brick, wood, pipe and electrical equipment.

Demo Tool Corp., 8735 Melrose Ave., Los Angeles, Calif.

BALDOR

Look...here's our secret



The new Streamcooled Baltric line of fully enclosed motors are better because they bring you power-houses in a more compact package. And this cutaway drawing shows you how our engineers combined the newest developments and newest materials to get more motor into less bulk. The Streamcooled Baltric line doesn't waste an inch or an ounce. These motors are easier to install, easier to handle... bring you modern efficiency and performance.

See how the rugged Unicast stator frame combines steel laminations in an aluminum alloy casting to get greater stability, rigidity. Improved insulation permits better slot design for copper windings. Improved techniques produce balanced, stress-free rotors. Every detail of design and construction is calculated to reduce size and weight without sacrificing performance and efficiency.

And Baldor has done just that. Built a better motor. Streamcooled Baltric's your best bet... doesn't waste space... doesn't waste weight... easier to handle and install.

Original Streamcooled Baldor Motors Available — Built to Former NEMA Standards

B A L D O R E L E C T R I C C O M P A N Y

*Baltric Motors Are Available in Polyphase • Squirrel Cage
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PARAGON ELECTRIC COMPANY

TWO RIVERS, WISCONSIN

Wires and Cable

(46)

A new line of high-temperature silicone-rubber-insulated appliance and fixture wire, apparatus leads, control cable, defroster wire, heating cable, and power cable. They provide high temperature operation, 125°C to 200°C, excellent moisture resistance, flexibility similar to rubber insulation, and high tensile strength. Other qualities are better ozone resistance, greater flexibility and easier terminating.

General Electric Co., Bridgeport 2, Conn.



Process Timer

(47)

Repeat cycle process timers that operate continuously to turn circuits on and off for constant interval operation are now offered with the added advantage of percentage timing. Advantages of percentage selection are constant accuracy in repeated operation and reduction of strain on electrical components. The unit has a time cycle of from 15 seconds to 24 hours, with a range of adjustability for on or off periods up to 94%. It is applicable for use on radiant type heaters, hold fire controls, mixing machinery, testing equipment, fans, etc. Timer is equipped with visible dial, snap action switch with silver contacts, synchronous motor. Size is 5-in. high, 3-in. wide, 3-in. deep.

Zenith Electric Co., 152 W. Walton St., Chicago 10, Ill.

Air Conditioners

(48)

A new line of packaged air conditioners has been developed for completely waterless operation. Designed for use in stores, suites of offices and other large spaces where water may be limited or where there may be piping difficulties, the new Weathermaker models employing air-cooled refrigeration are available in sizes from 2 to 7½ horsepower. The air-cooled condenser can be installed on a roof or setback or even inside the building with ducts to supply outside air. Units provide cooling, dehumidification, filtering and circulation of air from a single cabinet. They may be installed right in the space to be conditioned, releasing air through

louvers, or they may distribute air by ducts connected to the space to be conditioned. All of the refrigeration components, except the condenser, are housed in the styled cabinet. Winter heating can also be obtained from these units.

Carrier Corporation, Syracuse, N. Y.

Product Briefs

(49) Brush Electronics Co., Cleveland, Ohio, announces an electronic tester for textile measurements. . . . (50) New metal graphite **brush grades** for electrolytic plating generators have been announced by Stackpole Carbon Co., St. Marys, Pa. . . . (51) Sampson Chemical & Pigment Corp., Chicago, Ill., has introduced the Sun-Lite-Aire, an electronic home air purifier.

(52) A new two-wire **thermocouple**, encased in stainless steel tubing, has been introduced by Minneapolis-Honeywell Regulator Company, Minneapolis, Minn. . . . (53) Regulator Equipment Corporation, Paterson, N. J. has announced a new universal magnetic amplifier **regulator**. . . . (54) An improved, totally-enclosed dial-type **rheostat**, has been developed by Colbert Die Cast Co., Manufacturing Division, South Gate, Calif.

(55) A prefabricated, specially compounded polyvinyl chloride electrical cable **tubing** named Protektinsul, is now being used to prevent chafing of wires located at hinge points in the switchgear made by the I-T-E Circuit Breaker Company, Philadelphia, Pa. . . . (56) Hetherington, Inc., Sharon Hill, Pa., has developed pushbutton "B1000 Series" **switches** rated for resistive loads of 5 amps, or inductive loads of 3 amps at 115 volts ac or dc. . . . (57) A new line of hermetically sealed differential **relays** may be used for automatic overload, over-voltage, undervoltage or under-current protection. They are manufactured by Ameriprite Company, New York, N. Y.

(58) A 60 kw 600°F electric oven with rotating hearth to heat up airplane motor cylinders for shrink fitting cylinder liners has been announced by Lydon Brothers, Inc., Hackensack, N. J. . . . (59) A new 14-inch **Tube-axial blower** of unplasticized polyvinyl chloride for expelling corrosive air, fumes and gases is being manufactured by Industrial Plastic Fabricators, Inc., Norwood, Mass. . . . (60) A new, patented, non-breakable **insulating sleeve** for indoor neon signs has been announced by the Relyon Products Co., Chicago, Ill.

(61) A new heavy duty "Quick Hot" electronic **soldering gun** has been introduced by Wen Products, Inc., Chicago, Ill. . . . (62) McLean Engineering Laboratories, Princeton, N. J., has introduced a new line of attic fans available in three sizes, 20-, 24- and 30-

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As superintendent of a leading hospital equipment company responsible for the erection and installation of metal cabinets and laboratory equipment at the N.Y.C. V.A. Hospital, I used Rawlplugs extensively. This was in preference to any other type fasteners being used in a similar type of construction. My experience with many types of fasteners has proven to me that the Rawlplug has saved my company many labor hours over that of others.

(signed) Joseph Turkowski, Supt.

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inch. . . (63) A new vault-type network **transformer** with a radiator that is designed for strength and ease of cleaning and repainting has been announced by the General Electric Company, Pittsfield, Mass.

(64) The Perkin Engineering Corp., El Segundo, Calif., recently announced the addition of a new 28-volt 300-amp tubeless magnetic amplifier regulated **power supply** to its line. . . (65) Electrical Facilities, Inc., Oakland, Calif., has developed the Knopp split-core current **transformer**, Type W-400, for use with a rotating standard for measuring and integrating electric power. . . (66) A new **battery charger**, manufactured by the Electronic Rectifier Company, Rochester, N. Y., is designed to charge several batteries at one time: ie, 1 to 5 24-volt aircraft batteries, or 1 to 10 12-volt batteries, or 1 to 20 6-volt batteries may be charged simultaneously.

(67) A new line of high power, uni-directional small **motors** is offered by Barber-Colman Company, Rockford, Ill. . . (68) A new Robot automatic **stock feeder** for use on the farm has been introduced by Tork Clock Company, Inc., Mount Vernon, N. Y.

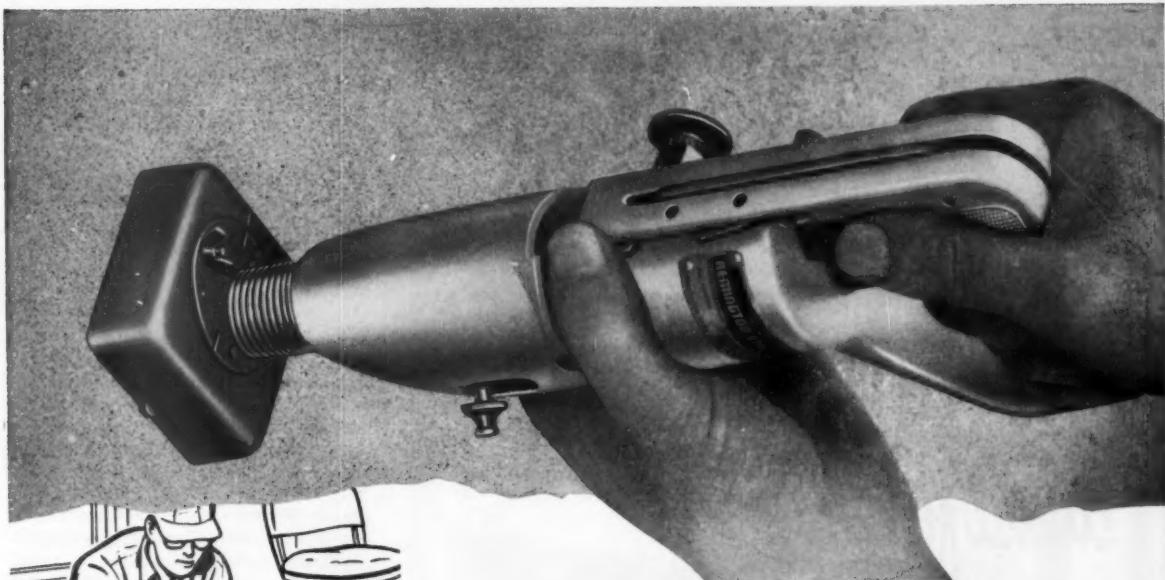
CATALOGS and BULLETINS

(69) **CABLE FITTINGS** are classified as copper-to-copper, copper-to-aluminum or aluminum-to-aluminum in a new 40-page catalog which also lists terminals, grounding equipment and hoists. Prices and dimensions. Jasper Blackburn Corp.

(70) **ELECTRIC HEATERS**. Bulletin H71E, 4 pages, discusses operating features of radiant glass heaters which are available in four styles in ratings up to 1500 watts. Two types of convection-heating electric wall panels are illustrated in sheet H76E. The humidifier-radiator model is unique in that it will not burn out if operated without water. Both the waterless and the humidifier models are designed for permanent mounting. Electromaid Corp.

(71) **VAPOR SPRAY DEGREASERS** feature stainless steel troughs and condensing coils, one-bolt action doors. Table showing eight standard models gives working space, heat requirements, dimensions and solvent capacity of each. Bulletin 754. Ramco Equipment Corp.

(72) **INDUSTRIAL LIGHTING FIXTURES** for many applications are described in this 6-page condensed catalog which



Anchoring seats, bar stools to concrete



2" x 4" plates to concrete floor



Carpet gripper anchored to concrete

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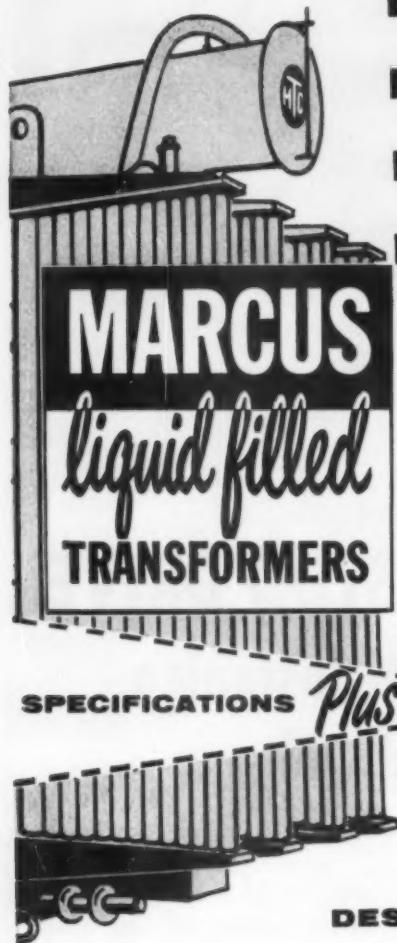
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RAHWAY, NEW JERSEY

illustrates high bay units, incandescents for indoor or outdoor area lighting and several units specially designed for gymnasium and pool illumination. 30a/MU. Multi Electric Manufacturing Inc.

(73) ANTENNA AMPLIFIER for small master systems requiring from 2 to 50 television receiver outlets. Folder 3R2468 lists key features and performance of the MI5185 assembly. Radio Corporation of America.

(74) LAMP BALLASTS. In addition to complete electrical and physical data, a new 12-page catalog has reproductions of ETL performance reports on the various types of fluorescent lamp ballasts. Starring & Co., Inc.

(75) STORAGE BATTERIES. Their applications and maintenance techniques are the subject of 20-page bulletin 210. Particular emphasis is given to methods of selecting the proper battery for the job. Exide Industrial Div., Electric Storage Battery Co.

(76) COMMERCIAL LIGHTING. Attractive Brochure 55 is composed of nine folios, each on a particular lighting system or fixture. Folios include large detailed illustrations of units and design features as well as operating characteristics and specifications. F. W. Wakefield Brass Co.

(77) FASTENERS having pre-assembled conical neoprene washers afford protection against leaks and minimize vibration, will conform with concave or convex-surfaces. Available with various types of screws, bolts and nails. Brochure TL 97, 4 pages. Townsend Co.

(78) TAPES. Results of tests performed on both rubber and friction tapes by a qualified testing laboratory are given in an 8-page folder entitled "How Good Is Accurate Tape?". A test kit is offered with instructions for quickly checking the physical characteristics of the product. Accurate Manufacturing Co.

(79) DIMMER for residential lighting is rated at 360 watts, 120 volts. Bulletin L954T, 8 pages, gives applications, installation procedures and prices of the Luxtrol light control. Superior Electric Co.

(80) HEATING CONTROLS for vaporizing oil-burning appliances. Included in this 8-page condensed catalog is a selection chart describing 23 basic types of constant level valves with applications and proper thermostatic control accessories. A-P Controls Corp.

(81) VOLTAGE REGULATOR provides precise regulation of 400 cycle genera-

tors with exciter. 8-page brochure offers detailed description of the type 1101 Recostat unit. Regulator Equipment Corp.

(82) SCHOOL LIGHTING REQUIREMENTS and systems are discussed in 20-page Booklet B-4556-B. A tabulation of the advantages and disadvantages of various systems evaluates each on the basis of performance, appearance, cost and maintenance. Westinghouse Electric Corp.

(83) ARMORED DC MOTORS for applications requiring heavy-duty, low maintenance power. Type MD and MDP 600 series motors are the subject of Bulletin GEA-4654-C, 20 pages, which covers design features, accessories, dimension and performance tables. General Electric Co.

(84) EXPANSION FASTENER for anchoring apparatus to soft or brittle walls relies on an expanding neoprene sleeve which is engaged by rotary action of a special key. Available sizes are 10-24 and 1/2-20. 6-page pamphlet. Rocket Devices Corp.

(85) AIR PURIFIER for mounting in air ducts affords dual benefits of ultraviolet germicidal lamp and an ozonator. Unit is rated at 20 watts, 110-120 volts. 4 pages. Sampson Chemical and Pigment Corp.

(86) FLUORESCENT FIXTURES and illuminated bathroom cabinets are described in 12-page catalog. Fixtures include residential and commercial units. Winton Manufacturing Co.

(87) RESIDENTIAL WIRING GUIDE for wall mounting gives load and circuit requirements for electrical equipment commonly found in the home. Also available is a promotion booklet entitled "The ABC of Home Wiring" that describes the whys of adequate wiring in non-technical terms. Up to 50 copies free, \$5 for each additional 100. Kennecott Copper Corp.

Books

(88) ELECTRONIC DICTIONARY containing over 3,500 terms used in television, radio and industrial electronics includes more than 150 illustrations of electronic equipment and circuits. 37 K756, 72 pages. \$25. Allied Radio Corporation, 100 N. Western Ave., Chicago 80, Ill.

Correction

The price indicated for the National Electrical Code Handbook reviewed on page 140, E.C.&M., December 1954, was a printer's error. The correct price is \$7.50.



NEW
from Black & Decker!
A compact, lightweight
3/8" Drill for only \$38.95

HERE'S a brand-new drill from Black & Decker, powered and geared to the correct torque and speed for drilling with all types of bits! Perfect for jobs like drilling holes in machinery for mounting controls, cutting holes for bringing in cable and conduit, etc. And it's compact for those hard-to-work-in spots—between joists and in service boxes.

Here are the specs on this new tool: Drives up to $\frac{3}{4}$ " wood bits, $\frac{3}{8}$ " twist drills, $\frac{1}{2}$ " masonry bits, and $1\frac{1}{4}$ " Hole Saws. Weight only $3\frac{1}{4}$ lbs. Overall length: Just 8". Speed 1000 rpm. Motor: B&D-built, 115 v., AC-DC. And it's designed for use with the B&D Screw Driving Attachment!

It's a good bet you can use this new $\frac{3}{8}$ " Utility Drill in your work. Find out by getting a free demonstration at your nearby B&D outlet. For more information, write: THE BLACK & DECKER MFG. CO., Dept. 2301, Towson 4, Maryland.



New $\frac{3}{8}$ " Utility Drill Kit

Perfect kit for the electrician! Includes the $\frac{3}{8}$ " Utility Drill plus 3 Hole Saws, 3 masonry bits, 3 wood bits, 8 twist drills. Steel box has ample space for carrying additional items. **\$64.95**



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Reader's Quiz

How to Ground the Neutral

QUESTION B27—When grounding a 2500 kva, 4160-volt *Y* connected system, is it best to ground it through a resistor, a reactor, or ground it solidly? And why?—M.D.

ANSWER TO B27—The best method of grounding a 2500 kva, 4160-volt wye connected system will depend somewhat on conditions which are not described in the question. Factors which are significant are:

1. Is it intended that conventional ground fault relaying, consisting of three current transformers and three relays (one in the common return conductor of the current transformer secondaries) will be provided?
2. Is the system served by a 4160-volt wye connected generator, or a 4160-volt wye connected transformer?
3. Are 2300-volt single phase loads served from line-to-neutral?

System neutral grounding is provided primarily to avoid the overvoltages associated with an ungrounded system. To accomplish its objective the neutral circuit impedance should be proportionately high in resistance, and it must be low enough to allow adequate current to flow to permit effective operation of protective equipment such as relays. Both conditions will be met if the ground fault current is between 25% and 100% of the system 3-phase fault current at the same fault location. It can be considerably lower than this if the neutral circuit impedance is essentially all resistance. Low ground fault current is desirable to minimize damage at the point of fault.

In the large majority of cases the proper method of grounding this system is through a resistor. This is based on the assumption that conventional ground fault relaying is provided. The resistor should be selected to provide a ground fault current equal to or greater in magnitude than the rating of the largest current transformer associated with the ground fault relaying system. In this system a resistor of approximately 6 ohms is indicated.

If the ground fault protective scheme depends on series trip devices it may be necessary to ground solidly to provide enough ground fault current to actuate the devices.

An exception to the above will be the system which serves 2300-volt single phase loads from line-to-neutral. In this case, it will be necessary to ground the neutral solidly to avoid overvoltages on load equipment when a ground fault occurs on one phase.

The only condition which might require reactor grounding is the combination of line-to-neutral loads served from a generator. Here solid grounding is demanded, but the generator windings may not be braced to withstand ground fault currents of higher magnitude than 3-phase fault currents. This would usually be the case, because generators are designed to present considerably lower reactance to ground fault currents than to 3-phase fault currents. For this condition, a low value reactor may be inserted in the neutral to limit the ground fault current to a value equal to the 3-phase fault current.

The exceptions noted are rarely encountered in systems similar to the one described.—L.J.C.

ANSWER TO B-27—It is difficult to answer this question in a clear-cut manner since many unknowns exist and each method of grounding has its place.

The main purpose in grounding any neutral point of any system is to reduce voltage strains during a ground fault and to assist in relaying by giving relatively definite values of fault current during a phase to ground fault.

Impedance or Z , equals the square root of $R^2 + X^2$ and unless R has values equal to one-third or more the value of X , the resistance does not have an appreciable effect upon the value of Z .

Above 300 kva ratings, it is not erroneous to assume that the impedance of any transformer consists mainly of reactance and very little resistance.

If the 2500 kva were used as a substation for a medium sized plant with an incoming primary voltage of 13.8 kv, it would be impractical to ground the neutral either through a resistor or reactor simply because of economics. Present day breakers are designed so as to interrupt the available short circuit current from this transformer with ease. Discounting any additional transformers in parallel with the 2500 kva unit, the asymmetrical 3-phase short circuit current, assuming a 50% induction motor load and a transformer im-

pedance of 5.5%, would be approximately 9000 amperes. This does not represent too severe a duty for a 5-kv breaker.

If it were desired to reduce the value of short circuit current to a lesser value for relaying purposes, a per unit addition of reactance would have a greater effect in reducing the short circuit current than the insertion of a per unit addition of plain resistance.—W.V.W.

Removing Defective Set Screws

QUESTION C27—In our electric motor repairing, we find that many times it is necessary to extract bad Allen screws that are of hardened steel which cannot be drilled with ordinary high speed twist drills. Can someone suggest a method of extracting these screws?—A.J.D.

ANSWER TO C27—The problem is not hardened screws as much as the surface that breaks the drill, or forces the drill to jump around. I use a collar, and a sharp high speed drill. Sometimes I soap the sides and then solder a rod to the broken screw.—H.S.

ANSWER TO C27—It has been my experience that almost any hardened steel set screw can be removed in the following manner: Use a No. 29 or 31 drill to make a hole in the set screw approximately $\frac{1}{4}$ -in. deep. Since this is such a small drill, it will generally leave a hole not much wider than the bad slot in the set screw. Since many set screws are not hardened all the way through, starting at the bottom of the slot with the small drill gives you considerable advantage over using a larger drill. Next use a retriever which is a hardened steel tapered drill of reverse spiral to "screw out" the bad set screw. The retriever is commonly used in conjunction with a tap holder or may be turned with a small crescent wrench.—R.C.L.

ANSWER TO C27—Had the same kind of trouble with bad Allen set screws. Solved it by arc welding a proper size welding rod to the Allen set screw: applied a bit of penetrating oil—then turned the screw out. Works nine times out of ten.—A.S.J.

**Engineer your high voltage supply
system at lowest cost with**

S&C Metalclad Switchgear



Geo. M. Baxter,
Plant Engineer at
Harper, points to
tie unit.

THE H. M. Harper Company did! This company, located in Morton Grove, Illinois, manufactures nonferrous fastenings. A few years ago it began a long range plant expansion program by modernizing its electrical system — distributing its power at high voltage.

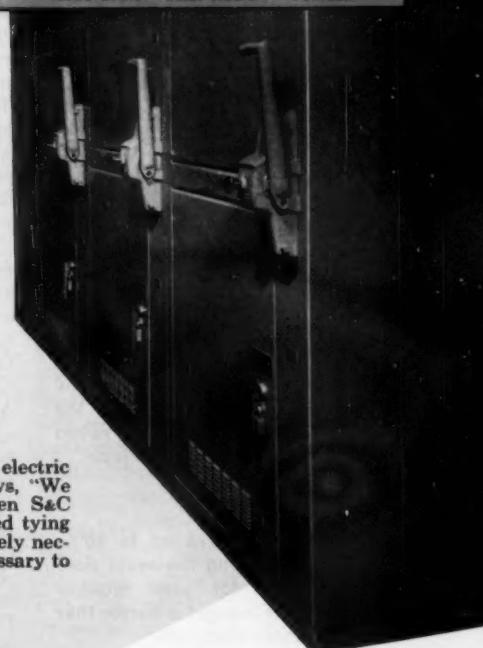
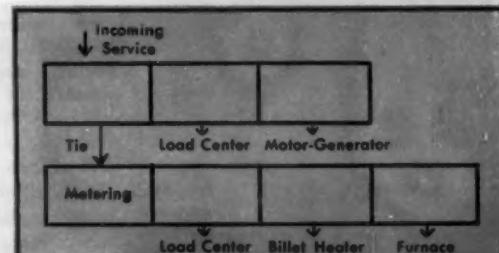
The first step was installation of S&C Metalclad Switchgear—a 3-unit assembly which served a load center and a motor-generator, and provided a spare for future needs. Two years later a second 4-unit assembly was added to serve the new metals plant, and was tied to the incoming service through the spare unit of the original assembly.

S&C Metalclad Switchgear is engineered to perform all the necessary protective and switching functions—yet it costs only about half as much as most alternate equipment. As a result the economies from its use are often tremendous.



Mr. Don Rieger

of C & H Electric Co., who planned and installed the electric power distribution system at The H. M. Harper Co., says, "We were especially pleased that our original choice had been S&C Metalclad Switchgear when the latest changes necessitated tying the two switchgear assemblies together, because it was merely necessary to change fuses in the tie-in unit . . . it was not necessary to replace expensive breaker equipment."



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S&C Switchgear
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heater, furnace,
and load center,
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Save up to 25%. With the wide range of Furnas Electric starters to choose from, you don't have to waste money on starters too big for the job.

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The many in-between sizes in the Furnas Electric line allow you to choose the control that is best suited for your particular job.

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You can save up to 40%. By selecting the exact size starter for your requirements you get a starter that is more compact.

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Overhauling Load and Motor Current

QUESTION D27—What happens to the stator current in a polyphase squirrel cage induction motor if the motor is driven at synchronous speed by an overhauling load? Can it be driven faster than synchronous speed?—R.E.B.

ANSWER TO D27—When a polyphase motor is driven at exactly synchronous speed by an overhauling load and is still connected to its supply circuit, the stator current becomes practically zero, since all the motor losses are being furnished by the mechanical overhaul source.

When the motor is driven at higher than synchronous speed while still connected to its supply circuit, the slip becomes negative and the rotor conductors cut the revolving flux of the stator in the opposite direction. Then the rotor induced voltage and current will reverse with respect to the flux. The result means a reversal in direction of power flow across the air gap or in other words we have a generator action. Within the limits of the motor capacity, the more the speed is above synchronism the greater will be the return of power to the supply system. There are certain single phase railway systems in the United States and elsewhere making use of this regenerating principle to brake long freight trains down grade. The savings in brake shoe wear are appreciable.

The theory of regeneration for induction motors is discussed in Standard Handbook for Electrical Engineers and in C. P. Steinmetz's Electrical Engineering, both McGraw-Hill Book Company publications.—C.O.D.

ANSWER TO D27—If an induction motor is driven at synchronous speed by an overhauling load, the stator current goes down to its minimum value (probably between 10 and 20% of its rated current) at low power factor, since, under this condition, the only power required from the supply source is the excitation of the stator and its I^2R losses. If it is driven faster than synchronous speed, as is done frequently for braking applications, it becomes an induction generator and will pump power back into the supply lines. This can be seen by the fact that its watt-hour meter will reverse when overhauling.

Assuming its rated slip is 3% when fully loaded, it will exert full-load torque for braking purposes when driven 3% over synchronous speed.

This characteristic of an induction motor is utilized for regenerative

braking of mine hoists, and conveyor belts carrying loads down hill, and similar applications.—E.A.M.

ANSWER TO D27—If a 3-phase induction motor is driven at synchronous speed by an overhauling load the stator current will be slightly reduced from the no load value. It will be reduced by that amount that would be necessary to produce a torque to overcome mechanical rotational losses such as windage and friction. In other words, the "active" component of the stator becomes zero, but reactive component which supplies the necessary main flux and leakage fluxes remains unaltered as it does through the range of induction machine performance.

The induction motor can be driven at greater than synchronous speed if sufficient mechanical torque is applied to the motor shaft. The machine will then act as an asynchronous generator and there will exist an "active" component in the stator current which is being delivered to the line rather than being drawn from it as in motor operation. The amount of "active" component delivered depends on how much faster than synchronous speed the machine is driven. However, the asynchronous generator cannot supply its own magnetizing current but will continue to draw a reactive magnetizing current from the lines as does the induction motor.—C.W.L.

Uses for a Tachometer

QUESTION E27—I have used "Standco" vibrating reed tachometers to measure revolutions per minute on motors and totally enclosed rotating equipment with much success. I would like to know if men in the plant or field have found other uses for these instruments for tasks relating to vibration measurement or vibration study.—H.J.F.

ANSWER TO E27—It frequently happens in a plant that excessive vibration is obtained from a given machine. By the vibrating reed tachometer it is possible to find the frequency of resonance of this vibration and therefore determine the source of the trouble. For example, if a motor running at 1800 rpm is driving a machine at 1200 rpm, and the tachometer shows a pronounced resonance at 1200 rpm, it is clear that the vibration is coming from the machine rather than from the motor. Also, by putting the tachometer at different parts of the machine the relative amplitude of the oscillating reeds will give a clue where the fault may be. Actually, with careful in-

terpretation of the amplitude of the various reeds a good deal of information can be obtained.—H.H.S.

ANSWER TO E27—Quite a few years ago there was a condition, when a newly installed large frequency changer was operating, where people living in the neighborhood complained of the vibration. Our department used a vibrating reed tachometer and a specially constructed more sensitive device to check on the vibration in the neighborhood and to aid in adjusting the frequency changer to eliminate this vibration.—E.B.

Can you ANSWER these QUESTIONS?

QUESTION T27—How does the efficiency vary between zero voltage and full voltage at various loads for rectifiers and filters?—E.B.

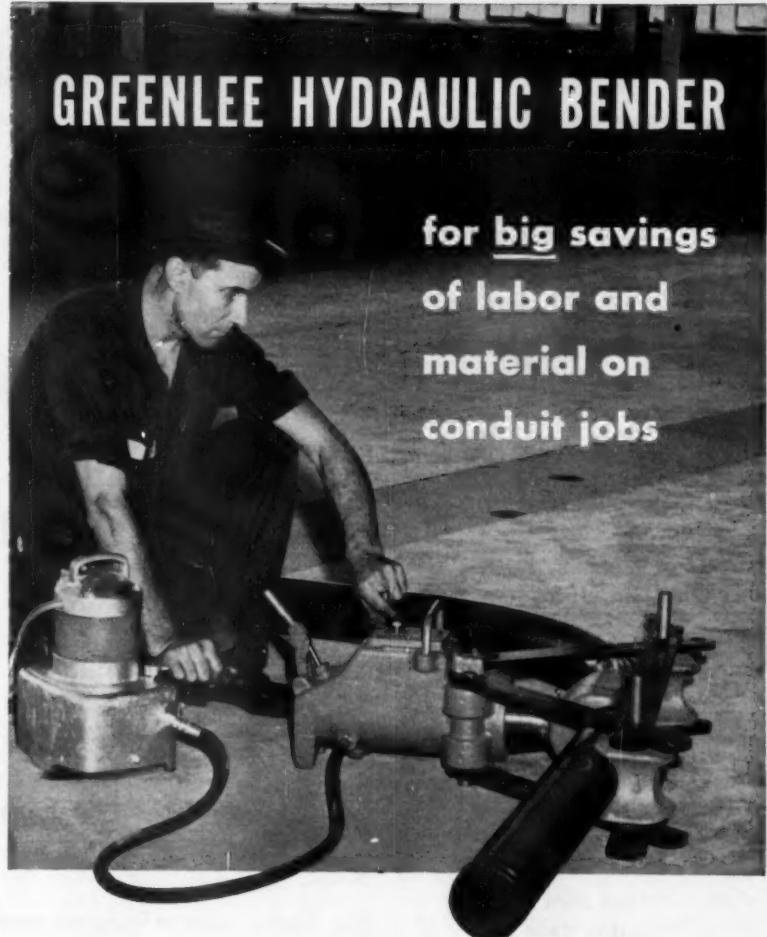
QUESTION U27—In our plant, we have been periodically using a 500-volt dc Megohm to test insulation resistance on 115-volt to 440-volt equipment with very good results. We now have some new generating equipment which operates at 660 volt ac. Is there a conversion factor which we can use to apply to readings so that this 500-volt dc instrument can be dependably used on 660-volt equipment?—C.A.K.

QUESTION V27—We have a number of 1.2 and 2.0 kw motor generator sets installed on railroad cars to convert dc to ac for fluorescent lighting. Many of these are equipped with pre-lubricated sealed ball bearings. We would like to know what attention these bearings should receive when the machines are overhauled. Should they be cleaned, inspected and regreased, and, if so, how? The m-g sets are generally overhauled every 24-36 months during car shoppings.—D.H.N.

QUESTION W27—When hooking-up a 33 kv to 2.4 kv delta-delta transformer (polyphase) it was necessary to connect it to an old 2.4 kv line, just as an emergency line. One engineer said all we needed was a phase rotation meter. Another engineer said phase rotation with polyphase transformer is not enough and went on to say that even when phase rotation is correct it must also be checked for angular displacement with another testing device. Who is correct and why?—M.D.

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Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.

GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

B. Z. SEGALL, Consulting Electrical Engineer, New Orleans, La.

Farm Rewiring

Q. We have taken several farm rewiring jobs and are finding it almost impossible to do a good job on these farms because of the voltage drop problem. Is the farmer not being unduly penalized under Section 2202 of the Code, which requires that the voltage drop on a circuit supplying combined lighting and power loads be confined to only 1% as the space between buildings is often such that it is not possible within practical reason to comply with this requirement?—R.M.C.

A. The section you refer to, 2202, refers only to the voltage drop on feeders and conductors within a specific building and not to the distribution between buildings outside. The Rural Electrification Administration realizes today the serious necessity of improving electrical characteristics on their customers' properties and they have advised the various individual cooperatives they should make a serious attempt to assist the farm customers in correcting these low voltage conditions. When you stop and realize that the average REA distribution system was predicated on a contemplated load of 100 kilowatts per customer per month and that now on some cooperatives this loading per farm customer has actually reached 600, 700 and 800 kilowatts, it becomes very easy to understand why the farmers are having voltage drop troubles. Many of the REA Cooperatives are now undertaking to move the transformer in as near as possible to the load distribution center on each farm and undoubtedly this move will do more to correct low voltage conditions than any other single change which might be made as it is not uncommon on many farm properties to find the transformer at a considerable distance from the distribution center on the farmstead. While the present code covers only the voltage drop on the conductors within the building, it is, of course, essential that considerable thought be given the voltage drop on conductors running between buildings or to the buildings from the load distribution center. And even though multiple tap transformers

may be employed, it is unwise to attempt to use a higher voltage tap to correct poor voltage drop conditions due to the fact that for a greater part of the day total connected loads will be small, permitting excessive voltage at outlets. It would therefore seem in order to recommend the voltage drop from the central distribution point to the individual outlets in any building be kept as near 3½ or 4% as is possible. Undoubtedly a future edition of the National Electrical Code will carry regulations governing this problem.—G.R.

panelboards which do not contain branch circuit switches, it follows when such switching is not provided, that such panels could be protected as high as their rating.

In support of this opinion I quote Official Interpretation No. 363 issued August 11, 1950, as follows:

"Question: Does Section 3882 (1951 Code) permit the feeder overcurrent device to serve as the overcurrent protective device on the supply side of a panelboard provided it is of a rating that does not exceed that of the panelboard?

"Answer: Yes."

While the above finding applies to Section 3882 of the 1949 Code and the rule has been changed under Section 3883 of the 1953 Code, the present wording is such that the interpretation appears to apply in either case. It appears to me that the Code makes a distinction between a panelboard which contains 30-amp snap switches and one not so equipped. In the first case we have a hazard presented by a snap switch which when a fault occurs could be destructive and serious if the overcurrent device back of same was not limited. As a result a definite commitment is made by the 200-amp limitation. If the Code intended to place the same restriction on a lighting and appliance branch circuit panelboard that did not contain snap switches, it would have made a definite statement to this effect under Section 3883. In view of the foregoing, it appears definite to me that a 30-, 60- or 100-amp lighting panelboard, with or without snap switches, is considered protected by a 200-amp overcurrent device on the feeder. It also follows that a lighting panelboard without snap switches, rated at 300 amps would be considered protected by a 300-amp device protecting the feeder.—B.A.McD.

Panelboard Overcurrent Protection

Q. We would appreciate having your interpretation of Section 3883a of the Code concerning panelboard protection for panelboards having feeders with overcurrent protection in excess of 200 amps. A specific example which we have in mind is a feeder which is protected by a 225-amp breaker and which serves two panelboards. The first panelboard is classified as a power panelboard and has 400-amp mains. The second panelboard on the same feeder is classified as a lighting and appliance branch circuit panelboard and has mains of 225-amp capacity. The question is, should the second panelboard have a main breaker to satisfy Section 3883a of the Code? One interpretation which we have is that the Code is satisfied because the second panelboard is protected on the supply side by a breaker with a rating not greater than that of the panelboard.—W.A.S.

A. I agree with the opinion already given that a lighting and appliance branch circuit panelboard, rated at 225 amps and served by a feeder protected by a 225-ampere overcurrent device fully meets the provisions of Section 3883 without resort to the use of a 200-ampere breaker at the panel provided that the panelboard is not equipped with snap switches rated 30 amps or less as covered by Section 3883b. While it would be unusual to find lighting and appliance

3-Phase 4-Wire Delta Service

Q. How do you size each of the service conductors including neutral and circuit breaker trips for a 3-phase, 4-wire delta service feeding 48-kw, single-phase, 3-wire 120/240

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lighting load and a 25-hp 3-phase, 240-volt single motor.—A.G.

A. The total current for the lighting would be
48 x 1000/240 or 200 amps

For this single phase load the maximum unbalance current (see Section 2203g) would be 200 amps. No further demand factor may be applied since this is the minimum unbalanced load permitted by the last sentence of 2203g (beyond this amount a 70% factor could be applied).

The 25 hp motor according to table 24, Chapter 10 has a full load current of 64 amps.

All these currents are line values and while they may not be in phase with each other they may be added arithmetically. Actually the lighting load will be at 100% power factor or close to this value, whereas the motor will be at about 90% power factor at full load.

Therefore, two lines will have both the lighting load and the motor load or 200 plus 64 or 264 amps, total

The third line would have only the 64-amp motor load. The neutral will carry the maximum unbalance load of 200 amps. The tabulation shows the conductor size corresponding to this for type RH conductors as shown by Table 1, Chapter 10, the square inch area of each conductor as shown by Table 13 and the total cross sectional area of all four conductors.

Phase A, motor & lights

264 amps-300 MCM — .6837 sq. in.
Phase B, motor & lights

264 amps-300 MCM — .6837 sq. in.
Phase C, motor only

64 amps-No. 6 — .1238 sq. in.
Neutral

200 amps-No. 3/0 — .4151 sq. in.

Total 1.9063

Table 11, Chapter 10 shows a 40% maximum occupancy of the conductors, therefore, the conduit must have a minimum cross sectional area of

1.9063/4 or 4.746 sq. in.

The third column from the left of Table 12, Chapter 10 shows a 2½-in. conduit to have 4.79 sq. in. so we may use this as a minimum size.

The circuit breaker trips would be set for full voltage starting at a maximum of 250% of the full load motor current or,

2.5 x 64 or 160 amps.

For two phases this would also have the lighting load so the maximum rating or setting would be

160 plus 200 or 360 amps.

The third phase would have the 160-amp rating or setting. As you can see this would require quite a special service circuit breaker.

The most practical installation would be to terminate the service conductors in a junction box and immediately

adjacent to this box install a 175-amp service breaker (see Section 2403b and Section 4349) for the power and a 200-amp size for the lighting load.—B.Z.S.

bear the above mentioned U.L. label they could serve as raceways for circuits other than the one feeding the fixture. The use of conduit nipples between such approved combination raceway fixtures should not, in my opinion, influence such installations. This however is a personal observation which should be checked by your local inspector.—B.A.McD.

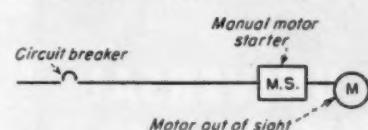
Control Switch

Q. May a circuit breaker be used as a control switch for a transformer type arc welder?—S.L.L.

A. Yes, providing the ampere rating of the breaker is at least equal to that of the rated primary current of the welder. You will find this permission under Section 6313 of the National Electrical Code, where it provides for either a switch or a breaker as the controller for such a welder. You will note that where a breaker is not used, a switch must be rated in horsepower and not in amperes.—G.R.

Motor Controller and Disconnect

Q. Does a motor out of sight having a manual motor starter for overload protection also meet the code as a disconnect switch?—A.G.



Fluorescent Fixtures as Raceways

Q. I find that I am in need of an interpretation of Article 410, Paragraph 4150, Page 116, of the 1953 Code Book pertaining to fluorescent fixtures when used as a wireway.

1. When installing fluorescent fixtures with removable end plates coupled together end to end in continuous rows, can circuits other than those needed for the fixtures themselves be installed and carried through the housing of the fixtures?

2. If fluorescent fixtures without removable end plates are installed end to end with the use of chase nipples, can circuits other than those needed for the fixtures themselves be installed and carried through the housing of the fixtures?—I.S.

A. It appears to me that the answer to both questions would be "Yes" provided the fixtures involved meet the requirements for approved raceways. On page 89 of the 1953 Electrical Equipment List of Underwriters' Laboratories, we find the following advice:

"Fixtures which include raceways are labelled as 'Fixtures Suitable for Use as Raceways' under the classification of Fixtures. See Raceways, Surface for raceways which can be assembled and installed as lighting units."

Reference to pages 330 to 332 of the same equipment list shows the raceways together with the number of wires permitted which may also be used as a fluorescent fixture.

If the fixtures you have in mind

A. In the diagram you show, the circuit breaker would most probably act as the disconnecting means. If this is "arranged to be locked in the open position" we need look no further for code acceptance, since Section 4409 permits this construction (see also Section 4386).

If this circuit breaker cannot be locked in the open position then the manual motor starter can serve as the disconnect provided it can be so locked in the open position. Otherwise a second disconnect must be installed within sight of the motor location, as required by Section 4386b.—B.Z.S.

Branch Circuit Loading

Q. Does Note 4, Table 1 of Chapter 10 and Section 2125a require No. 10 wire on branch circuits which supply small unit heaters in addition to lights? The circuits are protected in the light panel by 15-amp circuit breakers. Would 1-inch conduit for four branch circuits from the 3-wire 120/240-volt lighting panel be required?—C.J.

A. Section 2125a of the Code covers the maximum load permitted on any of the branch circuits covered by this Article, when motor-operated appliances are used in addition to other loads such as lighting. Under such conditions the total load connected to any of the various branch circuits shall not exceed 80% of the branch circuit rating. In other words a 15-amp branch circuit would be

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limited to 12 amps, a 20-amp circuit to 16 amps, etc. This rule apparently does not require No. 10 wire on branch circuits which supply small unit heaters in addition to lights. Such heaters could be placed on 15- or 20-amp branch circuits wired with No. 14 or No. 12 wire provided their ratings were such that the total connected load would not exceed 80% of the branch circuit rating.

Section 2103 recognizes the fact however that the rating of a branch circuit is determined by the overcurrent device and not the conductor size. In the case covered by your question, it appears that we have a 15-amp branch circuit wired with No. 10 wire. Such a combination is not unusual since factors often enter into the design problem which warrant such action. The answer to the second part of your question would depend upon the type of circuit, either 2- or 3-wire, used. In the case of 2-wire circuits we would have eight No. 10 conductors which according to Table No. 4 requires 14-in. conduit. If the branch circuits were 3-wire, we would have six No. 10 conductors which would require 1-inch conduit.—B.A.McD.

Remote Motor Disconnects

Q. We have a problem concerning the Code on one of our jobs at Holloman Air Force Base, as follows:

We have a building 17 feet square, 2-story, 22 feet high, and on the roof are four $\frac{1}{2}$ hp motors, 220-volt, single phase.

On the main panel, first floor, we have two 20-amp, 2-pole breakers feeding these four motors. The Inspector on the job claims that to meet the National Code we will have to install a disconnect switch near the motor on the roof. We maintain that the 20-amp, 2-pole breakers on the panel can also serve as the disconnect for the motors because there is a lock on the panel cover.

As this job is at Holloman Air Force Base the field inspector referred us to the Authorizing Representative of the Contracting Officer on the Base. Interpretation of the Code by the Authorized Representative, "we could not classify the breakers in the main panel as disconnecting means due to the fact that all panels are keyed alike and anyone else could obtain a key and open the cover". When we did not agree he suggested we contact the Authorized Representative of the Contracting Officer at Ft. Bliss, Texas, as he was more familiar with the Code. His interpretation of the Code was quoting Article 4402, paragraph a,

"we could not classify the breaker in the main panel as a disconnecting means for any stationary motor over $\frac{1}{2}$ hp". When we also disagreed with him he suggested we contact the Engineer of the Contracting Officer of the Corps of Engineers at Albuquerque. His interpretation of the Code was "we could use the breaker in the main panel as a disconnecting means if we could provide a locking device for the individual breakers". This is not as we maintain, by locking the cover so that all the breakers would be locked in whatever position desired—R.S.

A. This is a rather moot question as presented, and it must be pointed out quite emphatically that an authoritative interpretation can only be given as outlined in the Introduction to the Code in the second paragraph of the section entitled "Enforcement and Interpretation". The various discussions in the columns of the "Questions on the Code" section of this magazine are at most an expression of the judgment of each individual writer of his evaluation of the problem presented to him. His exposition or explanation of a Code problem is only official as the particular problem has been previously covered by an "official interpretation" obtained as outlined above, and which interpretation he quotes verbatim for this particular problem.

First, to cover the interpretations as outlined in the fourth paragraph of your letter, the question of keying does not enter the problem since a lock on each individual breaker can be supplied with two or more keys. Safety practices govern the "locking out" of circuits to prevent promiscuous "unlocking" of "locked out" circuits.

The interpretation with respect to 4402 is not true since inspectors will accept breakers in a panelboard as the disconnecting means for all size motors, provided they are installed in accordance with other Code requirements.

The final interpretation seems to me to hit at the crux of the solution for this problem. Section 4409 states "The disconnecting means shall be located in sight from the controller location or be arranged to be locked in the open position". This in my opinion would seem to require locking devices for individual breakers.

It would seem to be very impractical to accept a panel cover lock. Suppose a panel contained 40 motor circuits. Locking the panel cover to insure the protection of a single circuit which may be "locked out" for repair or maintenance purposes, would under normally accepted safety procedure keep all the other 39 motor circuits under safety control.—B.Z.S.

More Than Six Disconnects for Service Entrance

Q. Is there a change in the code that permits the use of circuit breakers consisting of 12 or more circuits without disconnecting switches?

We are on a housing project and are using the Square D XO circuit breakers. Is there a limit of circuits you may use before a disconnect switch is necessary?—K.K.

A. No, the 1953 Code is not a definite change but rather a clarification of the intent and an acceptance of a new development presented by the manufacturers. The third sentence of Section 2351a is new in the 1953 Code and this is a clarification of the intent as set forth in the previous editions of the code.

Thus if we have a 3-wire, 120/240-volt, single phase, or a 3-wire, 120/208-volt, "network" service feeding a building, our branch circuits may be multiwire circuits consisting of 3-wire, 120/240-volt or 3-wire, 120/208-volt branches, respectively. Each of these branches may be protected by two single pole breakers or switches. If for each multiwire branch circuit these single pole breakers or switches are equipped with (a) a handle tie between them, or (b) a handle on each pole which places the handles within 1/16 in. of each other, or (c) with a "master handle," so that one hand operation will open both single pole breakers at the same time, we may have as many single poles so arranged as will require six such operations of the hand and will not be required to have a main service switch.

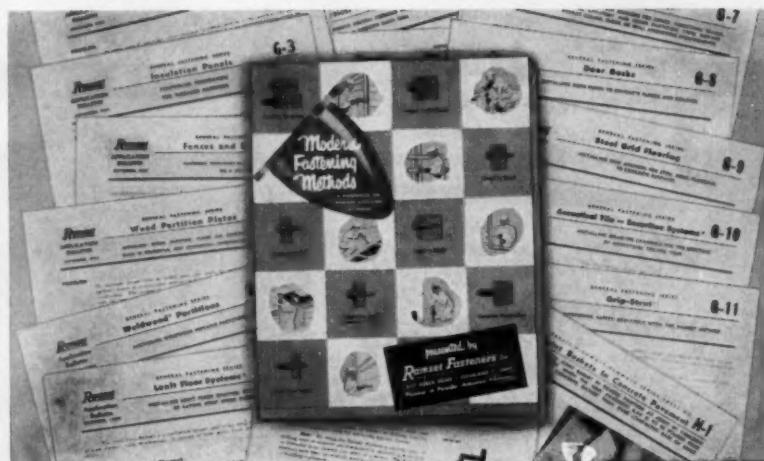
Since two single poles may be taken care of by each single operation of the hand, a total of

6 x 2 or 12 single poles may be used on these 3-wire services without a main.

Similarly if we have a 4-wire, 120/208-volt or a 4-wire, 277/480-volt, wye service, we may use 4-wire, 120/208-volt or 277/480-volt multiwire branch circuits with three single pole breakers or switches per each multiwire branch circuit. If these three poles are tied together, etc., then one operation of the hand will open all three branch breakers. Therefore a total of

6 x 3 or 18 single pole units may be so arranged for six hand operations.

The Square D Co Type XO is approved for service equipment and permits the use of more than 6 single pole units without a main service switch in accordance with the intent of Section 2351a (and Section 2371a).—B.Z.S.

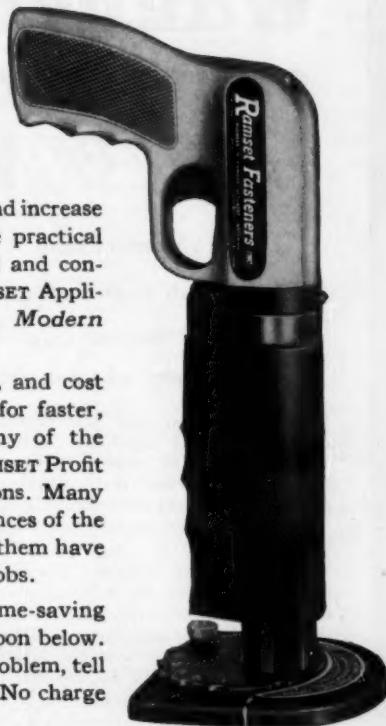


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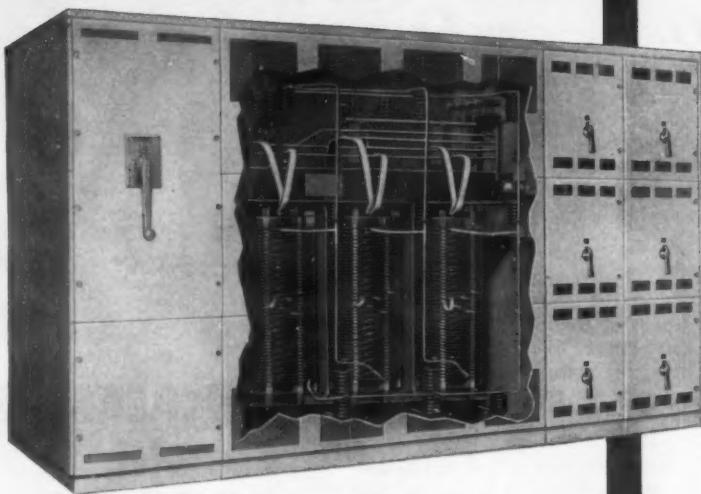
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The oven, Fig. 1, is an insulated, bolted steel enclosure with full size doors as shown. Loose rockwool and special cement are used in the construction of the enclosure. The exhaust stack is connected in a hole in the top of the oven and is taken up and outside of the building. An explosion-proof latch on top of one door catches strike and holds door in closed position with overlapping lip on this door holding other door closed.

The burner assembly is mounted on top of the oven enclosure. A spark

plug is mounted in a hole on the pilot burner and connected by a short length of high tension cable to an ignition transformer alongside the burner assembly. A flame rod assembly, consisting of rod and flame terminal, is screwed into a hole in the burner assembly so that the rod makes contact with the pilot flame. This flame terminal is connected by special sheathed cable to the main control board alongside the oven. Thermostats are inserted in the left front side of the oven.

An airflow switch is mounted to intake side of the unit's blower. A door switch is mounted on the door on the right side of the front of the oven, so that the switch arm makes contact against the switch when the door is closed.

The control center for the oven is a large board on which the control equipment is mounted (Fig. 2). The board is secured to a column off to the side in front of the oven. Power is supplied

to the center at 220 volts, 3-phase, through a 3-pole main switch fused at 30 amps and mounted in the upper right hand corner of the board. From this switch, 3-phase power is supplied to the oven blower motor through a magnetic starter on the board. The starter operating circuit is tied into a time switch and a master control thermostat set into the left front side of the oven. Two special control boxes for the oven are supplied at 110 volts, single phase tapped from the 3-phase supply. These boxes control valves in gas lines, ignition and auxiliary switches, in conjunction with another time switch and a temperature indicating control mounted directly above the board itself.

Operating sequence of this automatic oven control is as follows:

1. Time switch in fan motor circuit is set and hand trip is closed.
2. Main switch is closed.
3. Fan motor is started, closing airflow switch (Fig. 3). Airflow switch must close to energize all controls and electrical elements of the system. Oven door must be open to provide a closed ignition circuit before oven can be lighted. The door switch is closed when the door is open; it is closed when the arm on the door presses against it.

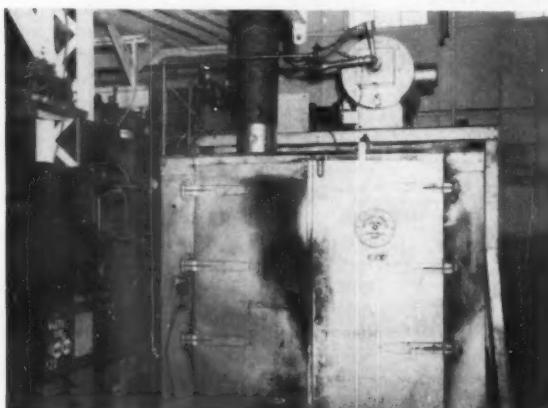


FIG. 1—Gas oven is automatically controlled in the motor repair shop of the Motor Division of Industrial Electric, Inc., New Orleans, La.

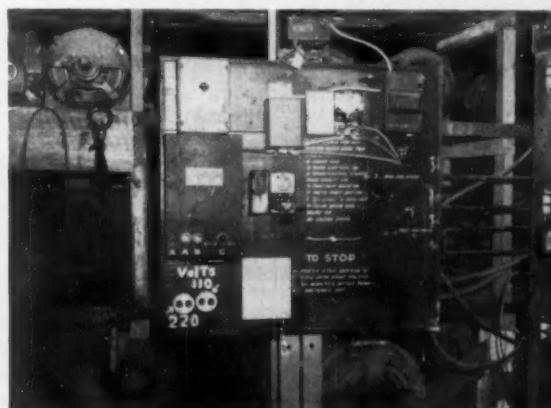
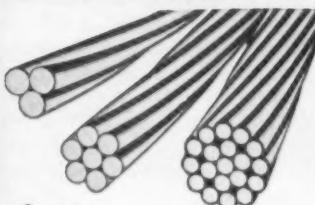


FIG. 2—Control center for the automatic oven consists of a large board on which the control devices are mounted as shown.

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PAGE

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Service
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PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! And—its lower cost per year of use means long-range economy.



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Better
Value

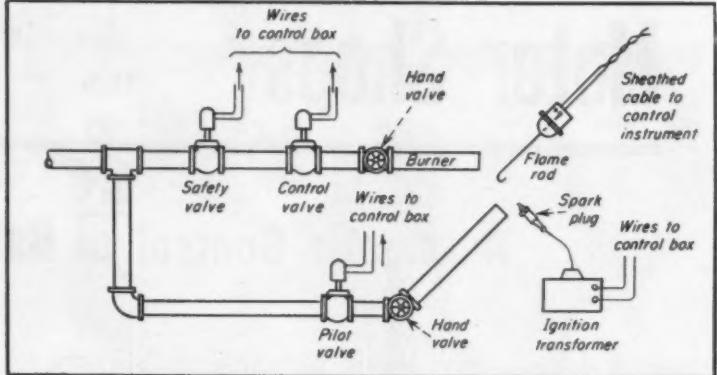


FIG. 3—Burner pipe and valve arrangement.

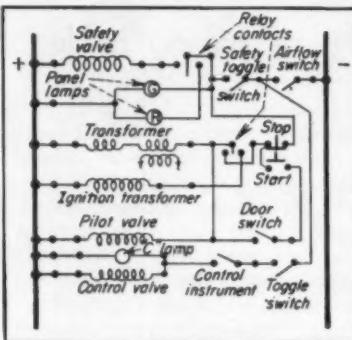


FIG. 4—Control wiring on single phase.

4. All hand valves are closed.
5. Desired temperature of oven is set on the indicating thermometer above the board.
6. Hand valve on pilot burner is opened.
7. Toggle switch marked "control" on control box is turned "on", connecting the control into the circuit and opening the burner control valve, lighting the amber pilot light (marked "C" on control box).
8. Toggle switch marked "safety" is turned "on", connecting a safety relay into the circuit.
9. Momentary contact "start" button is pushed and held in. This opens pilot valve and energizes spark plug, lighting pilot burner. When pilot burner ignites, it makes contact on flame rod causing safety relay to operate. Pushbutton is held until tubes in safety relay heat up and red light on box (marked "A") goes out.

10. Hand valve on main burner is then turned on, igniting the main burner. After the oven operating cycle is finished and the oven is going, the doors can be opened or closed without interrupting the fire.

When the oven comes up to the temperature set on the indicating controller, the control instrument operates the control motor valve to maintain

temperature within close limits of the set valve. The time switches provide automatic cycling and shutting-off of the oven. When the oven is shut down, hand valves are closed and the fan is left on until the combustion chamber cools.

The oven was made by Despatch Oven Co., Minneapolis, Minn.

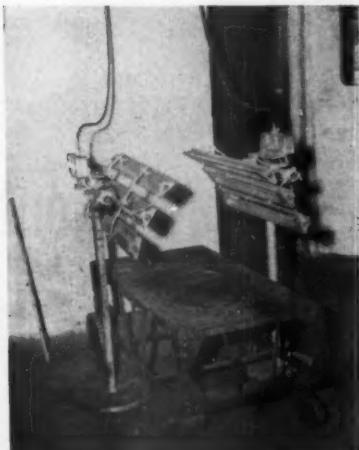
Baking with Infrared Heat

Throughout the country dozens of progressive motor shops keep customers and reputations by constantly improving their service, methods and work. In this manner they have been able to provide customers with numerous "plus" values and, at the same time, have been able to keep shop efficiencies up and overhead expenses down.

As an illustration, the Electrical Installation Company of Cambridge, Mass., applies a special plastic coating to motors subjected to excessive moisture, dirt, oil or lint, such as is found in mills, foundries, chemical or rendering plants. This special coating, placed on top of a conventional insulation job, then finally coated with an exterior application of orange lacquer, results in a smooth exterior that sheds moisture like a duck. It also results in longer coil life and lower operating temperatures, a combination conducive to impressive operating records.

This treatment is not new with this company, yet it frequently has been improved and kept up to date by changing the formula or revising the methods of application. Through this evolution, shop owner Paul Keating has earned a merited reputation for having some of "the newest and best" methods in town.

The plastic coating, applied only to open, mush-wound stator windings, is basically compounded of asbestos, asphalt filler and varnish. It is applied



RADIANT HEATERS in aluminum reflectors are placed in contact with motor frames to heat stator coils from the inside out, thereby thoroughly baking a special protective coating of asbestos-asphalt-varnish.

in two coatings, the first (of thinner consistency than the second) being sprayed on the windings by means of a gun-type twin-hose applicator. The second coat, is troweled on manually.

Each coating is followed by a baking cycle and, for this purpose, Keating now employs two banks of radiant Chromalox heating units. These units, mounted in groups of three on movable pipe stands, may be adjusted so that they are in contact with the outside of the stator frame. With practically no lost heat, radiant energy then passes through the frame to heat coils and bake the compound coatings thoroughly from the inside out.

The tubular heating elements are mounted in highly polished non-oxidizing aluminum reflectors which, in turn, are mounted to curved metal brackets. Wiring is simple, glare and gasses of combustion are non-existent, a separate oven is not required, a high heat density is obtained where needed, and the assembly is compact.



HIGHER POWER FACTOR in 3/4-hp room air conditioners (minimum of 85% at full load) by 1956 is the prediction of Henry G. Strong, executive secretary, Refrigeration Industry Safety Advisory Committee, as he toured the country addressing electrical inspector groups.

NOW-A Better Tap Connector THAT'S EASIER TO USE YET COSTS LESS!



The all-new IDEAL Tap Connector is the first big improvement in tap connectors in many years.

Its unique design not only gives greater mechanical strength — more contact area and more pressure, but also keeps the connector under constant spring tension. As a result contacts are better, wires can't work loose and "burnouts" are practically eliminated.

Easier to Stock!

ONLY THREE SIZES are needed for all combinations from two No.1 wires to one No.10 and one No. 12 or one No. 8 and one No. 14. Connectors are available *without* spacer bars for copper-to-copper or aluminum-to-aluminum, *with* spacer bars for copper-to-aluminum, copper-to-steel or aluminum-to-steel.

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JUST ONE UNIT!

No Parts to come loose

1. Place IDEAL Tap Connector on Main
2. Close Connector
3. Insert Tap, Tighten with a Wrench

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The IDEAL Tap Connector is lower in price than other connectors for practically every combination.

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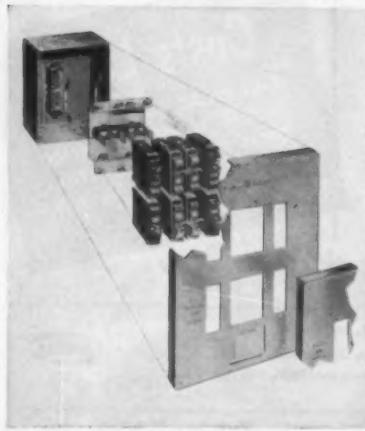
G. E. Announces two important new developments in service entrance equipment

**New 8 circuit
load center
is 3 ways
easier
to install**



NEW LOW PRICE: G-E's 100 ampere load center sells at 70 ampere prices! Type TRP810A 8 Circuit Load Center offers quality features—silver-plated copper for

current-carrying parts; corrugated copper bus bars for better contact, longer life, cooler operation; Bonderite* treated box and cover afford greater corrosion resistance.



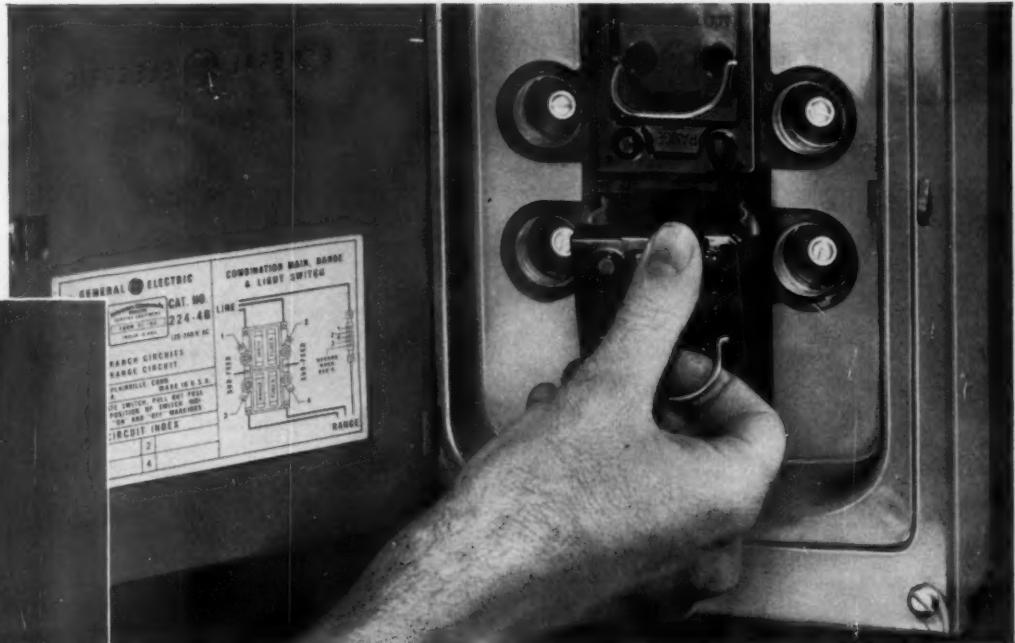
SNAP-IN INSTALLATION with unique spring mounting. Holds interior without screws—even when cover is off. Breakers and fronts align as cover is mounted.



STRAIGHT-IN WIRING means positive contact in easiest, most direct way. Double pole common trip Type TQL and single pole Type R breakers may be used.



NOTHING TO GET IN THE WAY when pulling wires. Mount upside-down or sideways if needed for easy orientation to line and load wire positions.

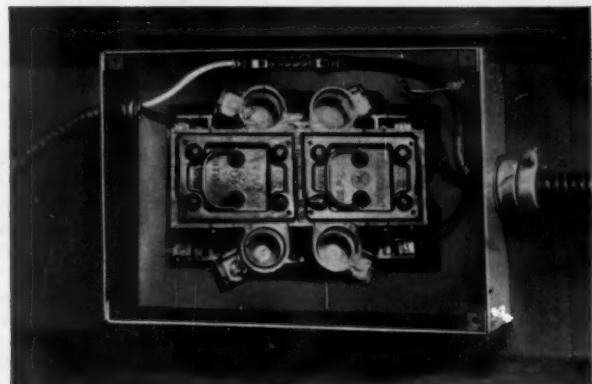


**New main, range and four circuit
fuse puller simplifies your job
from start to finish**

CURRENT-CARRYING PARTS are silver-plated copper. Bonderite* treated box resists corrosion. "On"—"Off" molded in for correct indication regardless of box position. Fuse pullers provide quick-make, positive-break. These exclusive G-E features are on the new Main Range and 4 Circuit Fuse Pullers 224-4B (surface front) and 224-4FB (flush front). See your Trumbull Distributor or write General Electric Co., Trumbull Components Dept. 48-60, Woodford Ave., Plainville, Conn.



EXCLUSIVE SLIDE-OUT INTERIOR (no screws) gives plenty of working room, facilitates pulling in line wires. Simple straight-in wiring may be made on all 17 connections.



FOUR MOUNTING POSITIONS permit maximum flexibility. Box may be mounted upside-down or sideways to fit any kind of area or to permit easier connections.

*Parker Rust Proof Company

Progress Is Our Most Important Product

GENERAL  **ELECTRIC**

Modern Lighting



Quality Lighting Aids Quality Production

A flexible lighting system which would supply quality lighting in quantity was demanded by Setter Brothers, Inc., Cattaraugus, N. Y., recently for their production plant where armormyl metal-covered Plywood is made exclusively for United States Plywood Corporation.

In commenting on this, Gordon D. Rowe, lighting specialist for General Electric Supply Company's Buffalo office, which supplied the equipment, said "It is a lighting man's occasional privilege to work with a customer who realizes the extra dividends provided by quality lighting and, to achieve that end, insists on being provided with the best obtainable lighting equipment. Such was the case at Setter Brother's plant."

The manufacturing process at this plant involves the lamination of steel or aluminum panels to Plywood. These finished panels must leave the plant free from scratches, glue deposits and handling marks. To detect such blemishes quality lighting of adequate intensity is mandatory.

The management of Setter Brothers also desired that the lighting installation be flexible. The nature of their business is such that what may be a manufacturing area today may be a storage area tomorrow. Thus it was necessary to provide a lighting system which could be altered in layout with

a minimum of time and effort to produce a wide range of illumination levels for any and all areas.

This problem was solved through the use of 300 Smithcraft Type ALS 8-ft luminaires, installed 16 ft 6 in. from the floor, and connected by cord and plug to an electrical lighting wireway attached to the bottom of the roof trusses above. Each luminaire is equipped with two 96-in. T12 slimline lamps which are operated at 430 ma from two-lamp high power factor ballasts, and with louvers having a 30-degree by 30-degree shielding angle. These luminaires were run in continuous rows, spaced 10 feet on centers, for a basic general lighting layout, and single 8-ft long units were installed normal to the continuous rows in areas where greater intensity was desired.

In general, the layout for each area was tailored to the function of the area. Thus layouts involved individual units, intermittent rows, continuous rows and grid patterns, interspersed throughout the plant to provide the versatility which the owners requested.

Illumination levels at the working plane after six months of operation vary from nine footcandles in storage areas to 47 footcandles in manufacturing areas. An excellent brightness ratio has been obtained between the luminaires and the ceiling, which is approximately three feet above the lumi-

naires, by painting the entire ceiling aluminum.

Luminaires are maintained from a maintenance platform, which is fitted with a safety rail, and which carries the necessary maintenance men and equipment. The platform is raised to the desired position by a fork-lift truck.

This lighting system was installed by Winship Electric Company, electrical contractors of Salamanca, N. Y. The lighting was planned by Gordon D. Rowe, lighting specialist for General Electric Supply Company, Buffalo, N. Y.

Setter Brothers officials have expressed complete satisfaction in this job and highest praise for those responsible for it. There has been a noted increase in employee morale, decrease in absenteeism, better workmanship and less spoilage. This is considered an excellent example of what planned lighting can do.

Effective Sign Employs Blue Fluorescent Filters

The Hillside Dairy plant in Cleveland, Ohio has an effective, inexpensive sign which attracts considerable attention.



LETTERS that apparently glow in the dark are top-lighted by blue-filtered fluorescent lamps as well as by flashing incandescent floodlights. Since fluorescents are operated constantly during the hours of the sign's operation, the on-off cycle produces a series of flashes and intervals of afterglow.

"LODESTAR"
by
MITCHELL



"LODESTAR" LIGHTED

Offices of American Photocopy
Equipment Company, Chicago

Architect—Henry L. Newhouse, A.I.A., Chicago

Lighting Contractor—LeRoy Electric, Chicago

Lighting Distributor—American Electric Supply Co., Chicago

BETTER LIGHTING FOR MODERN INTERIORS

MITCHELL "LODESTAR" Luminaires are lighting modern interiors everywhere. These trim-lined units offer important lighting advantages attained by a substantial upward component which provides a "general diffuse" lighting effect. Semi-translucent side panels achieve a pleasing low brightness contrast. The superior louver design delivers abundant, properly shielded illumination. This superior lighting with its smooth modern styling, unusually low maintenance factor and surprisingly low cost makes the MITCHELL "LODESTAR" Luminaire the wisest choice for Commercial, Institutional and School use...full details available on request.

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- **Modern, functional designs to harmonize with any architectural motif.**
- **Stock fixtures adaptable for all lighting layouts.**
- **Units designed for quick, easy erection. A minimum of on-the-job assembly.**
- **Patented E-Z Servicer.**
- **Designed and completely manufactured by WILEY with ETL Certified Electrical Components.**

District Sales Engineers Available for Prompt Co-operation



tion from passing motorists. The sign is located inside the plant proper, on the interior wall of what used to be a totally-enclosed, little-used corridor. Now, however, since the exterior wall of the passageway has been replaced by a huge glass area, this interior wall is plainly visible from outside.

On this wall is painted the name of the dairy in plain, simple, large letters, lighted from above by incandescent floodlights and blue-filtered fluorescents. Incandescent lamps are operated by a flasher device that causes the

sign to stand forth prominently on a 5-second on-off cycle. However, when floodlights are off, the filtered fluorescents continue to illuminate the letters in a dim, blue, glowing manner, resulting in comment-arousing recognition from motorists or pedestrians who pass the plant after dark. Since the corridor is rarely used for traffic of personnel during these same night-time hours, the on-off bright-glow lighting cycle does not constitute a source of annoyance or danger due to the intermittent flashes.



RESIDENTIAL STREET in Arlington, Mass., is illuminated to average of 0.4 foot-candles through use of 4000-lumen lamps on 110-foot spacing.

Bracket Arms Boost Intensities, Distribution

Tree-lined light-traffic streets in residential sections may be safe, restful and beautiful by day, yet heavy foliage and wide spacing of poles frequently combine to reduce night-time illumination to dangerous levels for motorists and pedestrians alike. That was the case on Warren Street, Arlington, Mass., before 6-foot bracket arms on 25-foot poles moved IES Type III luminaires

out towards the center of the 35-foot-wide roadway. Poles are staggered from one side to the other of the street at 110-foot intervals. With 4000-lumen lamps in service and with a minimum amount of judicious pruning of branches, average night-time intensities on the pavement are now 0.4 foot-candles, boosting the confidence of drivers and residents alike.

Louvered Ceiling Avoids Display Window Glare

Ceiling-high display windows in the new furniture store of John M. Smyth Company, Chicago are lighted to a high intensity with a minimum of glare. This is accomplished by using a plastic Louvered ceiling over the entire show window display area. This permits the attention of passers-by to be drawn to the home furnishings displays without the distraction of disturbing glare from the lighting which usually obtains under these conditions.

The Louvered installation features molded styrene louver panels 24 inches wide by 9 feet 6 inches long, supported

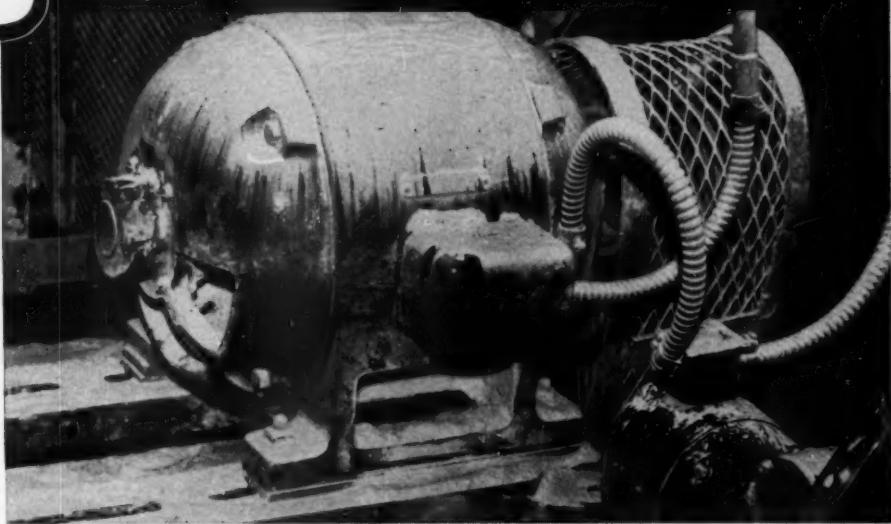
on T-frames installed normal to the high window glass. These plastic louvers have 1-inch by 1½-inch apertures, which provide a 45-degree by 35-degree cutoff.

The louver panels are supported 30 inches below the true ceiling. Lighting is provided by 40-watt 48-inch Rapid Start fluorescent lamps mounted on the surface of the true ceiling in the plenum above the louvers. The lamps are spaced 27 inches apart and provide an intensity of 55 footcandles down on the displays. The complete installation embraces a total of 1140

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SILICONES

one class H
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\$44,000
in
downtime
costs

make motors last longer



**10 hp Class H conveyor motor lasts over 36 times as long as
25 hp Class A; savings to date in downtime costs, \$44,000.**

A screw conveyor carrying dry stucco mix in the Kaiser Gypsum Company plant at Long Beach, California, was originally driven by a 25 hp Class A insulated motor. Damp material accidentally placed in the conveyor overloaded the motor causing burn-outs and work stoppages. With production shutdowns costing about \$700 an hour, every effort was made to prevent over-loading, but the motor still failed every 30 to 60 days. In December 1948, the Class A motor was replaced with a 10 hp Silicone (Class H) insulated unit. Although the silicone insulated motor has less than 50% of the name plate rating of the

Class A motor, it is still operating after 6 years of service without a single failure. At a conservative estimate, the saving in downtime costs alone is over \$44,000.

That's typical of the performance of silicone insulated electrical equipment under tough operating conditions in every industry; over-load capacity increased by as much as 50%; service life increased at least 10 times; production and maintenance costs reduced to permit a better profit margin. Top management, production and maintenance engineers are demanding more and more Class H insulated motors, transformers and solenoids, because they cost less in the long run.

You can also reduce to a minimum motor outages due to bearing failure by using Dow Corning 44 Grease

In open and single shielded bearings designed for high temperature operation, Dow Corning 44 has 8 to 10 times the life expectancy of conventional greases. It gives life-time lubrication in permanently sealed bearings.



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FOR 10 SECONDS**

SEE PAGE 33

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UNIVERSAL PRESSURE TYPE
ADJUSTABLE LUGS

One or two bolt holes

Wire sizes Nos. 14 to 1,000,000 CM. One-piece construction—easily installed. Body is well proportioned to withstand excessive use, with ample thread area. Makes tenacious grip on stranded conductors, forcing contact with each wire in strand, thereby insuring utmost in conductivity—bottom of tongue surface is ground. Not susceptible to release under vibration.

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KRUEGER & HUDEPOHL, INC.
15 EAST THIRD ST. CINCINNATI 2, OHIO



LOUVERED PANELS, supported 30 inches below the true ceiling, provide glare-free window lighting for John M. Smyth Co.'s new furniture store in Chicago.

square feet of louvered ceiling area.

The lighting equipment and louvers were manufactured by Electro Silv-A-King, and were installed by G. F. E.

Electric Company, electrical contractors. The installation was designed and specified by L. P. Summarkoff, architect and electrical engineer.



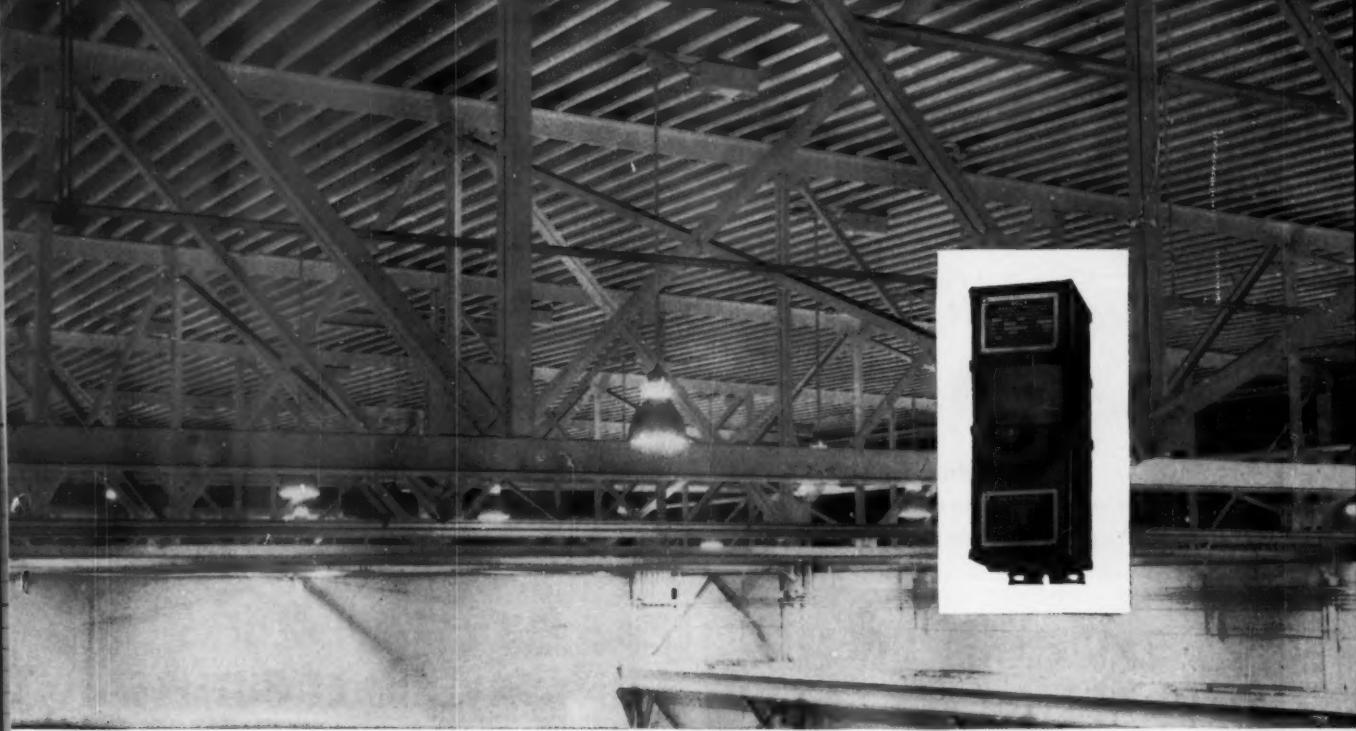
Ritual Hall Has Dimmer Controls

Levels of illumination may be gradually varied in the Grand Lodge of Masons' Ionic Hall in Boston by dimmer-regulating ceiling and wall luminaires from a central control panel. By this means, maximum footcandle intensities may be raised to 45 when desired, or decreased in accordance with the nature of the activities.

Overhead units, recessed into the 20-foot-high ceiling, are Century 368 baffled downlights. Plaster rings are painted to blend in conspicuously with the blue-tinted coffer treatment, and annular baffles create a reduced internal glow in each fixture without per-

mitting direct glare from the lamps themselves. Wall illumination is from spun aluminum adjustable bullet-shaped fixtures, located behind the columns in this 84-by-42-foot lodge room and directed upwards. Lamps in all units are of the 150-watt size. PAR 38 flood lamps are used for ceiling units and R-40s are installed in wall luminaires.

The color scheme is predominantly blue-white, with light blue upper walls, dark blue lower walls, blue carpeting and upholstery, and white columns. Reflectance factors are 47% for the ceiling, 38 for upper wall, 26 for lower walls and 87 for columns.



INTERIOR INSTALLATION CLOSEUP: Here's an unretouched photograph, taken at night, of the actual mercury vapor lighting installation at Richfield Oil Corporation's new refinery. The Sola Constant Wattage Transformers (see inset for transformer detail) are mounted against the ceiling and have been painted white.

Sola Constant Wattage Transformers maintain $\pm 2\%$ lumen output on mercury vapor lighting system in new Richfield Oil Corp. Refinery

The mercury vapor lighting system — like much of the other equipment installed at Richfield Oil Corporation's new California Refinery — is making news. It's newsworthy because it has set a new standard of excellence for interior, high bay, mercury vapor lighting.

The heart of the Richfield refinery's entire mercury vapor lighting system is the regulated energy supplied to the lamps by Sola Constant Wattage Transformers. Regulated operation of mercury vapor lamps results in the following eight advantages:

1. Constant light output within $\pm 2\%$ regardless of line voltage variations as great as 25%.
2. Lamps stay lit, even when line voltage drops as much as 40v (on 110v line).
3. Positive starting.

4. Elimination of primary taps.
5. Negligible starting current surge.
6. Protection on both open and short circuit.
7. Extended lamp life.
8. More ballasts can be installed on each circuit.

Outdoor weather-proof Sola Constant Wattage Transformers for mercury vapor lamps are also available. They have the identical advantages of the indoor type. They are particularly suitable for such industrial and commercial lighting applications as gasoline stations, plant protection, store fronts and parking lots.

These mercury vapor ballasts adapt the patented Sola Constant Voltage Principle widely used in Sola regulating transformers for electrical and electronic applications.



TYPICAL ILLUMINATION QUALITY:
Constant wattage mercury lighting for shop maintenance area of refinery

Write for Bulletin 17A—MV-211 for data

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TRANSFORMERS



REGULATING
OUTDOOR



REGULATING
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INDOOR

CONSTANT VOLTAGE TRANSFORMERS for Regulation of Electronic and Electrical Equipment • **LIGHTING TRANSFORMERS** for All Types of Fluorescent and Mercury Vapor Lamps. • **SOLA ELECTRIC CO.**, 4632 West 16th Street, Chicago 50, Illinois, Bishop 2-1414 • **NEW YORK 35**: 103 E. 125th St., Trafalgar 6-6464 • **PHILADELPHIA**: Commercial Trust Bldg., Rittenhouse 6-4988 • **BOSTON**: 272 Centre Street, Newton 58, Mass., Bigelow 4-3354 • **CLEVELAND 15**: 1836 Euclid Ave., Prospect 1-6400 • **KANSAS CITY 2**, MO.: 406 W. 34th St., Jefferson 4382 • **Representatives in Principal Cities**

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Designed for
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P & S KEYLESS LAMPHOLDERS

Practically every wiring installation calls for one or more of these lampholders. Strictly utilitarian, yes—but made of fine P&S porcelain with a quality P&S interior, they will give years of trouble-free service.

For 3 1/4" box—P&S 41.

For 3 1/4" and 4" boxes—P&S 110.



P&S 110

P & S PULL LAMPHOLDERS



P&S 4046-2

Feature one-piece construction—no separate shadeholder ring to loosen and fall off. Built-in mechanism of simplified design with terminal screws in most get-at-able position, eliminates necessity of removing interior to wire.

For 3 1/4" box—P&S 4026 with insulated chain, P&S 4026-2 with short chain and cord. For 3 1/4" and 4" boxes—P&S 4046 with insulated chain, P&S 4046-2 with short chain and cord.

P & S PULL LAMPHOLDERS with CONVENIENCE OUTLETS

Have same one-piece construction as the P&S 4026 Line, PLUS a convenience outlet connected internally—no extra wires, soldering or taping. Ideal for attic, basement, garage, etc., where inexpensive lampholder with outlet is desirable.

For 3 1/4" box—P&S 5026 with insulated chain, P&S 5026-2 with short chain and cord. For 4" box—P&S 5046 with insulated chain, P&S 5046-2 with short chain and cord.



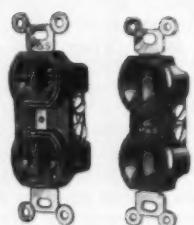
P&S 5046-2

P & S 1530 and 1570—The OUTLETS with COMPLETELY INSULATED BACKS

Both P&S 1530 and P&S 1570 are easy to wire. Large head binding screws are spaced far apart—bodies are shorter, leaving more room in box. Plate screw hole is strap—no rivet to twist or turn. Both outlets have long-life phosphor bronze contacts—washer type ears—easy find slots.

P&S 1530 (brown) and P&S 1530-I (ivory)—T slot type.

P&S 1570 (brown) and P&S 1570-I (ivory)—Parallel slot type, double grip contacts.



P&S 1530 P&S 1570

Illustrated are just a few of the hundreds of wiring devices in the complete P&S line. All lampholders shown conform to Fed. Spec. W-L-142. Outlets conform to Fed. Spec. W-R-151. Every P&S device is a quality device—the result of experienced engineering, precision manufacturing and rigid inspection. Every P&S wiring device is BUILT TO LAST.

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In The News

Winners in Lighting Competition

Contest Judges select 22 lighting installations for prize awards in the 1954 National Lighting Competition for Electrical Contractors.

Judging of entries in the 1954 Light's Diamond Jubilee Lighting Competition for Electrical Contractors was done on December 14, 1954, two weeks after the close of the contest. The three-man panel of nationally known authorities on lighting principles and practices who served as judges awarded 17 cash prizes and five honorable mention awards to 22 of the lighting installations entered in the contest, after nearly ten hours of review and analysis of all the entries, submitted by electrical contractors in the United States and Canada.

This contest was the second to be sponsored by *Electrical Construction and Maintenance* on lighting. It was one of the magazine's activities in commemoration of the Light's Diamond Jubilee program, and was designed "to foster and encourage outstanding lighting installations by electrical contractors, and to stimulate industry interest and activity toward the further progress of electrical illumination". It was announced in February 1954, closed December 1, 1954, and covered lighting installations completed between August 1, 1953 and the closing date of the contest.

The 17 cash prize awards totaled \$1300 in value. First, second and third prizes were awarded in each of five lighting classifications, and first and second prizes only were awarded in the sixth lighting classification. Lighting classifications were: stores, schools and offices, industrial, residential, floodlighting, and miscellaneous—covering banks, theatres, churches, restaurants, auditoriums, etc. First prize awards consisted of \$100 in cash, Award certificate, and 1000 reprints of an article to be published in a future issue of the magazine covering the lighting installation on which the award was made. Second prize awards consisted of \$75 in cash and an Award certificate, and third prize consisted of \$50 and an Award certificate. An

Award certificate only was given for honorable mention awards.

Lighting installations entered in this competition were located in 66 cities scattered across the nation in 25 states and in Canada. Number of installations per city ranged from one to 21, with Pittsburgh, Pa., holding the record for 21 lighting jobs entered.

Prize awards went to 19 contestants, located in 18 cities scattered throughout nine states and Canada. Three contestants each received two awards.

Contestants in Pennsylvania took nine of the 22 awards. Three of these were first prizes, one was second, three were third, and two were honorable mention. Pennsylvania also held first place in the first Lighting Competition held in 1953, with a total of seven cash prize awards and 13 honorable mentions.

The 1954 contest was open to electrical contractors or full-time employees of regularly established elec-

trical contracting firms only. As in the first contest, the rules required that the sale of lighting installations entered in the contest must have been initiated by the contestant or some member of his firm. This stipulation was made in order to rule out bid specification type lighting installations. Entries were also judged on five factors, which were: sales effort, customer benefits provided by the lighting system, effective use of industry aids and support, lighting adequacy and engineering features, and artistic appearance.

Many electrical utilities, electrical leagues, lighting manufacturers' representatives, and others supported this competition enthusiastically, and aided in its promotion with electrical contractors at the local level.

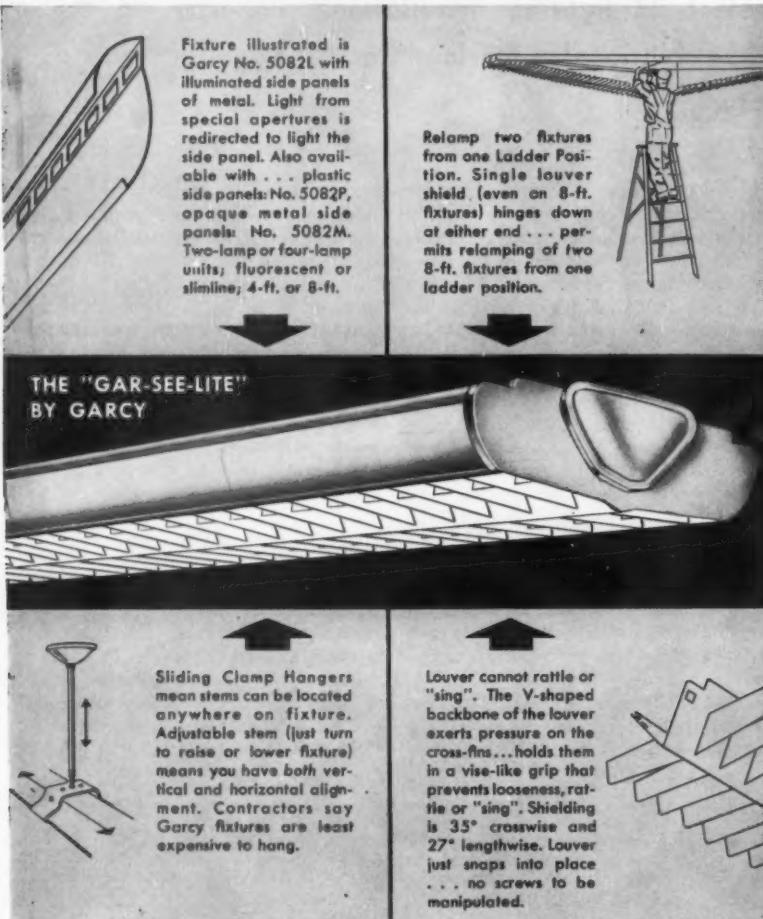
Judges for the competition were: Thomas F. Coghlan, illuminating engineer, Public Buildings Services, GSA, Washington, D. C.; C. L.



JUDGES hand winning entries to Berlon C. Cooper, chairman of the lighting competition. The judges are Richard Kelly, Thomas F. Coghlan and C. L. Crouch.

COMPARE!

**Quality features available
in no other lighting fixture**



PLUS ALL THESE "EXTRAS" THAT MEAN BETTER QUALITY!

Fixture ends are easy to wire-through. Large openings simplify wiring connections for continuous runs, cut installation time.

Ornamental end plates are die-formed and are designed especially for each fixture. Another example of Garcy thru-and-thru quality.

Safety link chain supports louver when it is lowered for relamping or cleaning. All "Gar-See-Lite" fixtures have chains at each end of fixture.

Compare—see for yourself why "Gar-See-Lite" fixtures are known as the lowest-priced quality fixture on the market. See how their features fit in with the specific need on so many of your installations. Check with your Garcy distributor for full details on cost, specifications, etc.

**GARDEN CITY
PLATING & MFG. CO.**
1730 N. ASHLAND
CHICAGO 22, ILLINOIS



GOOD ENGINEERING insuring adequate electrical capacity and quality materials sums up the philosophy of Charles J. Kirkpatrick, owner of Kirkpatrick Electric Co., Pierre, S. D. He recently celebrated his 35th year as a Pierre electrical contractor by moving his firm into new and larger quarters.

Crouch, technical director, Illuminating Engineering Society, New York, N. Y.; and Richard Kelly, lighting design consultant, New York City.

Lighting Competition winners were as follows:

STORE LIGHTING

First Prize: Milton W. Stratton, Independent Wiring Co., Philadelphia, Pa.

Second Prize: Robert E. Walton, Sweeney Electric Co., Gary, Ind.

Third Prize: Courtland W. Frick, Electrical Contractor, Glenside, Pa.

Honorable Mention: Robert M. McKenzie Electric Co., Chattanooga, Tenn.

SCHOOL AND OFFICE LIGHTING

First Prize: John O. Kvalsten, Kvalsten Electric Co., Inc., Minneapolis, Minn.

Second Prize: William H. Axelson, Axelson Electric Co., Youngstown, Ohio.

Third Prize: William H. Axelson, Axelson Electric Co., Youngstown, Ohio.

Honorable Mention: Frank R. Haubelt, Haubelt Electrical Co., Pittsburgh, Pa.

INDUSTRIAL LIGHTING

First Prize: John G. Zimmerman, Zimmerman & Walsh, Quarryville, Pa.

Second Prize: Andrew David Miller, Canadian Comstock Co., Ltd., Ottawa, Ont. (Canada)

Third Prize: Charles A. Holm,

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*Save you time, steps, effort...
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Time Equipment

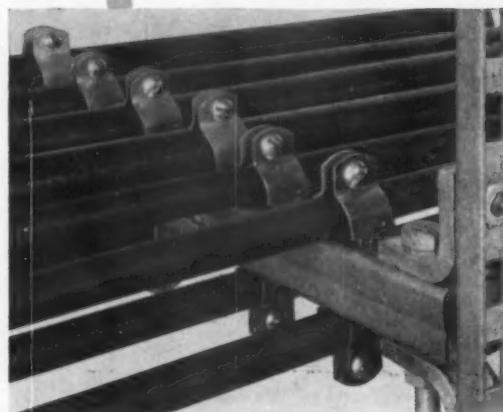
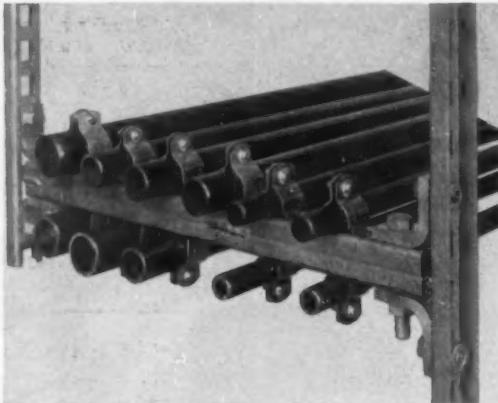
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STRUCTURES

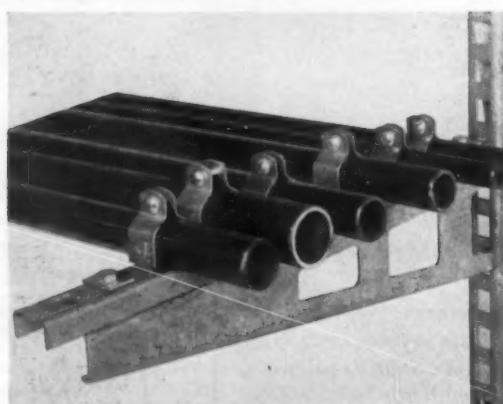
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EASY
INSTALLATION

Write today
for further in-
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Data Sheet.



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CORPORATION
711 SOUTH 50th STREET
PHILADELPHIA 43, PA.

Electrical Contractor, Prospect Park,
Pa.

RESIDENTIAL LIGHTING

First Prize: Jerry F. Burt, Burt
Electric Co., Fallbrook, Calif.

Second Prize: Kenneth A. Johnson,
Johnson Electric Co., Cokato, Minn.

FLOODLIGHTING

First Prize: Mahlon Miller, Elec-
trical Contractor, Phoenixville, Pa.

Second Prize: Robert Moser, Moser
Electric Co., Fort Worth, Texas.

Third Prize: Richard W. Jones,
R. W. Jones Electrical Co., Inc.,
Sharon, Mass.

MISCELLANEOUS LIGHTING

First Prize: Ellsworth C. Harper,
Jr., Sanford Electric Co., Sanford,
Fla.

Second Prize: Thomas J. Reilly,
Frame Electric Co., Pittsburgh, Pa.

Third Prize: Frank R. Haubelt,
Haubelt Electric Co., Pittsburgh, Pa.

Honorable Mention: Thomas J.
Reilly, Frame Electric Co., Pittsburgh,
Pa.; Murray Ford, Burton Ford &
Sons, Ltd., Hamilton, Ont. (Canada);
and Ralph B. Nuelle, Gibbs Bros.
Electric Co., Los Angeles, Calif.

U. S. Names Jersey NECA In Anti-Trust Action

In an indictment filed December 16,
1954, in the U. S. District Court for
the District of New Jersey, at Camden,
N. J., a federal grand jury charged
the New Jersey Chapter of the National
Electrical Contractors Association,
Inc., with violation of the Sherman



ELECTRICAL BLUEPRINTS are checked
during construction of Brooklyn's new
South Shore Incinerator by Henry
Menkes, Superintendent, left, and Ben
Feldman, General Foreman, both of Nager
Electric Co., electrical contractors for the
project.



JACK McGREW, manager of Gordon Electric Company's Austin, Minn. branch office (parent firm is Albert Lea) has full responsibility over a well-run construction division and an eye-catching display of appliances and fixtures in their main street location.

Anti-Trust Act. Also charged as defendants in the criminal action indictment were four electrical contracting firms and ten individuals, including electrical contractors who are association members and officials and the manager of the association chapter. Various persons not made defendants and not indicted were cited as co-conspirators who, according to the grand jury charges, performed acts and made statements in furtherance of the offence charged to the defendants. These co-conspirators include, according to the indictment: past and present members of the New Jersey Chapter of NECA, Inc., who have their principal place of business in the South Jersey area; three South Jersey electrical contractors' associations and members of these associations; and three Locals of the International Brotherhood of Electrical Workers.

The indictment states that from



NEW LINE of underfloor duct is shown to electrical inspectors Clarence J. Lawell (left) Hammond, Ind.; and Walter Grabski, East Chicago, Ind. (right) by James W. Hudson, Manager, Howard Electric Company, Chicago. Display was at the Western Section, IAEI convention.



"No shutdowns to take current readings"



"Takes the guesswork out of servicing"



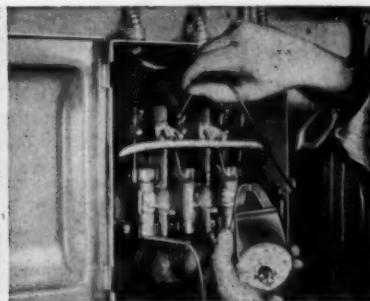
"Periodic motor checks pay off"



"No longer a problem to balance load"



"I can check appliance current at plug"



"A real short cut for checking fuses"

save hours this way!

Did you read the comments under the photos? They're typical reports from Amprobe users in the field, telling us how much easier their work has become now that they can measure current and voltage instantly and accurately, with one pocket tool, without having to shut down equipment.

There's an Amprobe for every job, every budget: from 10 amp and 250 volts to 1200 amp and 600 volts AC; from \$19.85 to \$67.50. See them at your jobber's today.

Send for valuable Amprobe service bulletins showing many more ways to save time and eliminate guesswork. Mail coupon now to: PYRAMID INSTRUMENT CORP., LYNBROOK, N. Y. (Export Div.: 458 Broadway, N. Y. 14), world's largest manufacturer of snap-around volt-ammeters.

Amprobe®

snap-around volt-ammeters

Send For Free Service Bulletins:

Pyramid Instrument Corp.

Dept ECM—15, Lynbrook, N. Y.

Please send me the Amprobe service bulletins checked below:

- How to cut costs and land more jobs
- Trouble-shooting electric motors
- How to boost service profits
- Electrical servicing of hermetic units

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*Floor Boxes
and Wiring
Specialties*

ADJUSTABLE
WATERTIGHT
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NON-ADJUSTABLE
WATERTIGHT
FLOOR BOXES

ADJUSTABLE
GANG FLOOR BOXES
1-2-3 AND 4

FLOOR JUNCTION
BOXES



Preferred Throughout The Industry

Because of their high quality, ready adaptability, ease of installation and sure performance "Latrobe" Products have won wide spread approval for all industrial, commercial and residential jobs.

Non-Adjustable Watertight Floor Box

Unique, practical design cuts installation time; makes safer job and leaves more wire space inside box. Cover Plate is 3½" diameter.

Adjustable Floor Box

Designed for telephone outlet or where permanent connections are made, or as a junction box. All adjustable boxes are fire proof.



Insulator Supports

Fastens porcelain or glass insulators to steel framework without punching holes. 3 sizes—1", 1½", 2" and 2½".



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Fish Wire
Ten sizes—
lightest work to
heaviest power wir-
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200 foot coils.



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FLOOR BOX
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• PIPE AND CONDUIT
HANGERS

• ARMORED
CABLE SUPPORTS

• CABLE CLIPS

• STAPLES

• FISH WIRE



THERE IS NO substitute for quality and workmanship in the books of W. T. Kraft, motto-making manager of Skeels Electric Co., Bismarck, N. D. His firm's success is based on his business philosophy that no deal is a good deal unless both customer and contractor profit by it.

about 1948 up to the present the defendants and co-conspirators have engaged in an "unlawful combination and conspiracy to suppress and eliminate competition in the sale and installation of electrical equipment—in violation of—the Sherman Act." It charges that the "combination and conspiracy consisted of a continuing agreement and concert of action among the defendants, co-conspirators and others—the terms of which are:

"That contracts for sale and installation of electrical equipment" in the South Jersey area "be allocated among the defendant and co-conspirator electrical contractors.

"That the South Jersey area be divided into territories—and that contracts—be allocated to, and the low



TALKING SHOP during corridor confab at Western Section, IAEI meeting are Merwin Brandon (left), vice president, Underwriters' Laboratories, Inc., New York and C. M. Park, Chicago, Western Section immediate past president.

Fullman Manufacturing Co.

1209-1215 JEFFERSON STREET

LATROBE, PA.



IN CHARGE OF CONSTRUCTION activities of the Electric Supply Company at Sioux Falls, S. D. is Edward W. Oebel who has held this responsibility for the past five years. Construction accounts for about 95% of annual volume with almost all of it in the industrial and commercial categories.

bid—submitted by—electrical contractors designated by mutual agreement among the defendant and co-conspirator electrical contractors having their principal places of business within such territory.

"That upon the request of the defendant or co-conspirator electrical contractor to whom a particular contract has been allocated" others "will refrain from bidding or will submit higher fictitious, fraudulent or 'complementary' bids—.

"That no defendant or co-conspirator electrical contractor will submit a bid— for a contract on a project — outside his own territory except as permitted by agreement—nor submit a bid which is lower than that



GERMAN SAFETY expert, Dr. Oskar Schneider, Stuttgart, addresses the Western Section, IAEI meeting in Louisville, Ky. Dr. Schneider, with 13 other representatives of German insurance companies, employers and labor unions, toured the U. S. studying American safety methods. Trip was sponsored by the Bonn Government.

It's easier... with Heinemann Service Equipment ...designed for the job



SAFELET has receptacle for power tools or appliances. Built-in circuit breaker interrupts short circuits and dangerous overloads, prevents damage to equipment that's plugged-in. For use in the home workshop, on the test bench or production line. Write for Bulletin 1010

RECEPTACLE TYPE OUTDOOR SERVICE UNIT is a portable, protected power outlet for temporary plug-in service. Easily moved from job to job. Write for Bulletin 2016.

INDOOR SERVICE CENTER replaces old-fashioned fuse boxes, combines either two, four or eight circuit breakers in a handsomely styled unit for mounting anywhere in the home or commercial property. In office building installation shown, each office has its own Service Center so that power interruptions are isolated. Heinemann circuit breakers assure immediate, simple restoration of service. Write for Bulletin 1002.



HEINEMANN ELECTRIC COMPANY
132 Plum Street
Trenton 2, New Jersey

HEINEMANN

Circuit breakers

Protect your CABLE JOINTS with G & W SPLICE BOXES

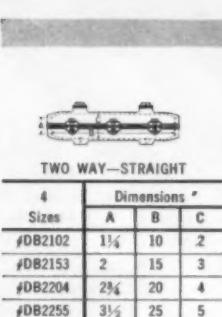


TYPE "DB"

Type "DB" Splice Boxes are split lengthwise in identical halves clamped together with galvanized steel bolts. These cast iron splice boxes are primarily intended for protecting lead sleeve joints on armored cables buried in the ground. They are frequently used for enclosing joints without lead sleeves.

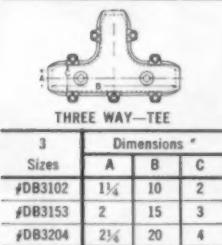
The top half has large filling holes (with gasketed plugs) for compounding. The bottom half has screws on inside of bosses for bonding metallic cable coverings.

Send for your copy of G & W Bulletin BA52 listing CABLE BOXES.



TWO WAY—STRAIGHT

Sizes	Dimensions "		
	A	B	C
#DB2102	1 1/4	10	2
#DB2153	2	15	3
#DB2204	2 1/4	20	4
#DB2255	3 1/2	25	5



THREE WAY—TEE

Sizes	Dimensions "		
	A	B	C
#DB3102	1 1/4	10	2
#DB3153	2	15	3
#DB3204	2 1/4	20	4

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U.S.A. In Canada—Powerlite Devices, Ltd.



50th ANNIVERSARY
G & W
1905-1955

BA52a

Steel Tape Armor

Lead or Neoprene



Interlocking Armor



PROONENT of good school lighting is E. M. Lothrop, owner of Lothrop's Electric Service, Huron, S. D. and former secretary of the South Dakota Electrical Contractor's Association. Among his and his son Eugene's more recent activities were the wiring of eight schools on the Cheyenne Indian Reservation and a school lighting survey for the Huron School Board.

submitted" by the designated contractor.

That the chapter manager and a representative of each division of the chapter "coordinate and effectuate the operations under the agreements—."

That any member of the New Jersey Chapter of NECA Inc. "who does not conform to the agreements and procedures—shall be expelled or forced to resign—and steps be taken to cause the termination and cancellation of all contractual relationships between such electrical contractor and union co-conspirators."

In a description of the "Nature of Trade and Commerce Involved," the indictment states that "During 1953



R. W. JONES of Sharon, Mass., developed a cast aluminum vulcanizing block, complete with cartridge heating elements and thermostatic control, to simplify, speed and improve splices being made in connection with underground cable installation serving one of Boston's parkways.



MORE THAN a half century in the electrical field is the experience R. B. Berndt brings to his customers in the Huron, S. D. area. He has been a contractor in Huron for the past 33 years; lists oil painting as his avocation.

approximately \$2,210,000 worth of electrical equipment was sold and installed in the South Jersey area by all electrical contractors operating therein employing union labor. Approximately \$1,210,000 worth of electrical equipment was sold and installed in the South Jersey area by electrical contractors having their principal places of business therein and employing union labor. Of this amount, approximately \$1,100,000 or 92%, was sold and installed by defendant and co-conspirator electrical contractors."

Architects Let Subs Separately

Electrical contractors in Sioux Falls, South Dakota report that architects in that area are cooperating in the development of a very practical bidding practice. Mechanical trades



WALTER D. ROACH, Louisville electrical inspector and general chairman of the Western Section, IAEI, Golden Jubilee Convention gets "jugged" at Little Brown Jug Luncheon session. Here he (on left) receives Brown Jug music box momento from Vince Mulligan, Ideal Industries, Sycamore, Ill.

When storms knock out electric power...



**an ONAN
Emergency Electric Plant
supplies essential electricity!
Prevents property damage: protects lives**

Danger to life and property, loss of business and customer goodwill, all can be prevented with Onan Standby Electric Power. When electricity is interrupted for any reason, an Onan Standby Plant will take over the power load supplying 60-cycle "highline" current for lights, motor-driven machines, electronic devices and other equipment.

Onan Electric Plants are built to run continuously . . . for as long as the emergency exists. Require little space for installation, run smoothly and quietly. All Onan units can be equipped with automatic controls.

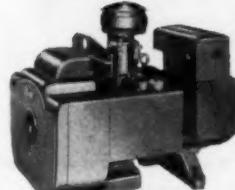
Onan gasoline-powered emergency electric plants are available in sizes from 1,000 to 100,000 watts A.C. . . . fill any need for standby power.

Write for FREE estimate!

*If you will let us know
your requirements we will
recommend the size and
type plant you need.*

D. W. ONAN & SONS INC.

2815 University Avenue S.E.
Minneapolis 14, Minnesota



MODEL 5CW 5,000 watts A.C.



MODEL 305CK 3,500 watts A.C.

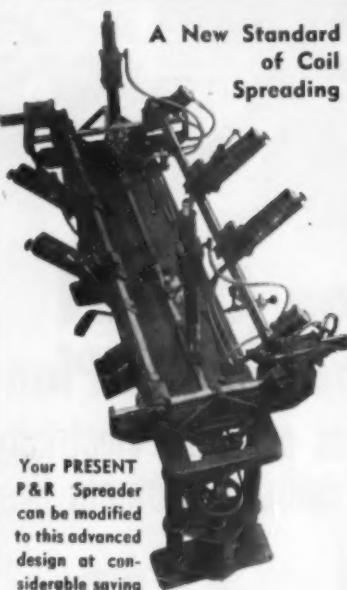


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Air Operated
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- ★ Packed with New Features and Advantages.
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**A New Standard
of Coil
Spreading**



Your PRESENT
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can be modified
to this advanced
design at con-
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**NEW SIMPLICITY
OF ADJUSTMENT**

... Two nuts and a handwheel
control spread and angle.

- Unparalleled Set-up Ease and Simplicity—Greater Production Speed.
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MACHINE WILL QUICKLY
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ALL-AROUND ELECTRICAL work, including electrical contracting and engineering and complete electric motor repair, is daily routine for Atlas Electric, New Orleans, La., under the able direction of its president Dan J. Duvoisin.

subcontracts (electrical, heating, plumbing, etc.) are being let separately on construction projects where the value of each subcontract exceeds \$5,000. Mechanical work below this figure is included in the general contract.

The net result is virtually elimination of unethical bid shopping and peddling around Sioux Falls, a practice said to be rather widespread in some areas of the country. Reports indicate that both architects and subcontractors are highly pleased with the advantages provided by this new arrangement.

**Electrical Contractor
Heads Jersey League**

Arthur L. Davis, head of the A. L. Davis electrical contracting firm in



ART DAVIS (right), electrical contractor of Newark, N. J., receives congratulations from Essex Electrical League's outgoing president Jim Kennedy of Harvey Hubbell, Inc. Art, as in this photo, is being backed by new Maintenance Division president Bob Chambers.



*Put your finger on the one
complete line...*



CIRCLE F MFG. CO.
TRENTON 4, NEW JERSEY



NEWCOMER TO the electrical construction field is L. J. Crain, estimator-engineer for Baumgartner's Electrical Construction Co., Sioux Falls, S. D. A former power company engineer, Crain reports rugged competition in the construction field with most of the activity centered around school projects.

Newark, N. J., has been elected to head the Essex Electrical League of that State for the coming year. At the same time, Robert Chambers, in charge of maintenance at the Daco Tool and Engineering Company, was elected as president of the League's Maintenance Division.

Art Davis, in assuming the duties of his office, follows the footsteps of his father, George Davis, who still actively participates in the organization he co-founded in 1911. In addition to his new office, Art is vice president of his local Kiwanis Club, is active in Jersey's N.E.C.A. program and maintains his interest in the U.S.N.R., in which he holds the rank of Lieutenant Commander.



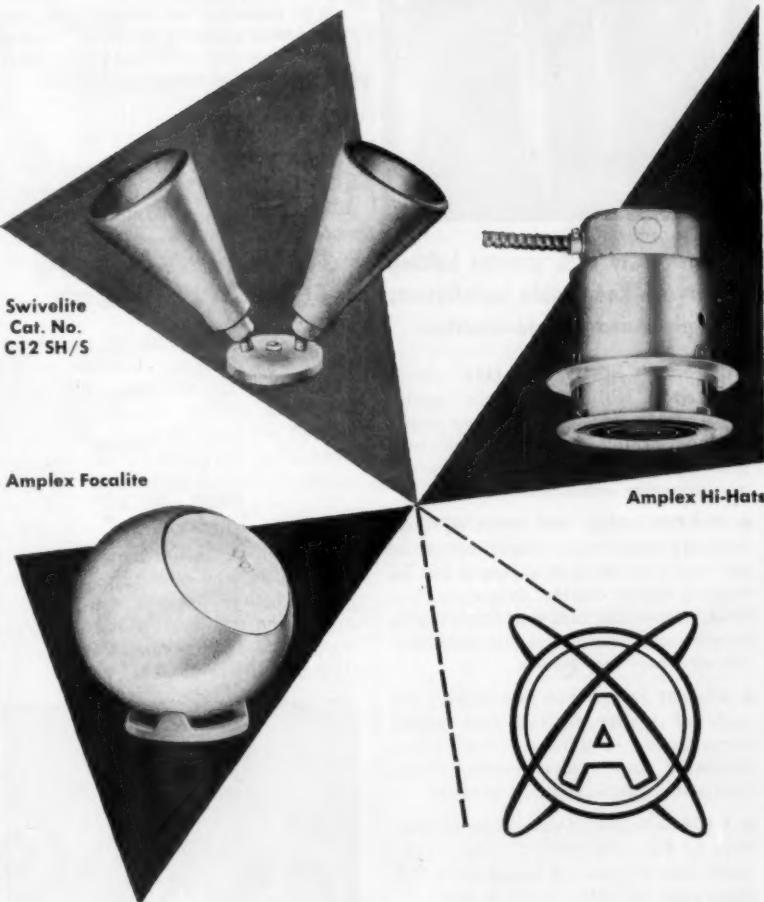
LARRY SCHWING, superintendent for Muhl Electric Limited, electrical contractors of Houston, Tex., is shown here outside the power house for the Baytown-LaPorte Tunnel, one of the many outstanding electrical jobs he has handled in and around Houston.

NEW LIGHT ON SELLING!

amplex

Accent Lighting Fixtures

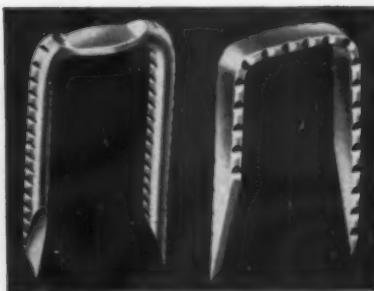
**ARE PROVED
PROFIT-MAKERS!**



SMART, MODERN accent lighting fixtures can enhance the beauty and selling-power of your displays. Small wonder that the new AMPLEX models are the choice of display men—they lead the field because they do a real selling job!

We'd like to tell you in detail about the AMPLEX "big four" exclusive features that put them far and above ordinary fixtures in lighting effectiveness and economy. Write today for catalog. **amplex Corporation, Dept. ECM-1, 111 Water St., Brooklyn 1, N. Y.**

AMAZING *New* CABLE STAPLES



provide up to 67% greater holding power . . . keep cable installations in place and in safe condition

• **HOLD-TITES REALLY HOLD TIGHT:** New Titchener "Hold-Tite" Cable Staples have barbed edges—to grip the wood and hold firmly. Laboratory tensile tests prove up to 67% greater holding power over same size ordinary staples.

• **HOLD-TITE STAPLES KEEP CABLES IN PLACE:** Ordinary cable staples often drop out or pull out a few days after they're put in. Sagging cables can be dangerous. Use Hold-Tites—make sure your flexible cable installations, metallic and non-metallic—stay up where they belong.

• **WILL NOT BEND:** Hold-Tite Staples are made of special analysis steel which doesn't bend or deform—even when hammered into hardest woods. Sharp, even points start straight, go in easily.

• **A COMPLETE LINE:** Available in six sizes. Four in flat wire (7/8", 1", 1 1/8", 1 3/8" inside length), two in round wire, E-Z Drive type (1", 1 1/4" inside length).



Send now for free box of Hold-Tite Staples!

E. H. TITCHENER & CO.
72 Clinton St., Binghamton, N. Y.



A LAKE APART in geographical location but of a common mind on electrical safety measures are Henry J. Looman (left), chief electrical inspector, Holland, Mich.; and Richard Vandermeer, electrical inspector of Kenosha, Wis.

NISA News

The St. Louis Downtown Lions Club has awarded Fred Briner, Briner Electric Co., St. Louis, a lifetime membership. Briner is one of the few members so honored by the organization.

• • • •

The shop of H. Roberge in Quebec, Que., was damaged severely by fire in October. Losses from the flames and from water damage were described as "quite heavy," and operations were disrupted for several days in the 21-man establishment.

• • • •

"Preventive maintenance is that phase of an over-all maintenance program which has to do with the discovery and repair of defects in equipment before a breakdown occurs," reads Small Business Aid No. 38, pub-



JOHN E. WISE, past international president, IAEI and electrical engineer, Industrial Commission of Madison, Wisconsin, receives a Certificate of Appreciation for his association activities from International President B. A. McDonald, at Western Section Golden Jubilee Convention.

KIRKWOOD covers the field in commutators



FROM CRANES to VACUUM CLEANERS

Whether your motor requirements call for a large industrial application or the smallest of household appliances, you'll find a Kirkwood Commutator to serve your needs and save you money.

We have over 1000 standard designs of molded core or steel core type commutators ranging in size from 9/32" to 50" diameter...so check with Kirkwood before designing a new motor.

Our engineers will be glad to work with you on special applications. Send us your prints for estimate.

WRITE FOR CATALOG NO. 3



**The KIRKWOOD
COMMUTATOR CO.**

Over 10,000,000 now in use.

4855 West 130th Street
Cleveland 11, Ohio



ENGINEERING KNOW-HOW is what Albert Innocenti, electrical engineer, contributes to operations at Gulf Electric Company, Houston, Tex., electrical contractors on many of the large scale electrical jobs in the Houston area.

lished by the Department of Commerce, Washington 25, D. C. The four-page paper is available free, and is another in a series of "technical aids for small business" which the government is publishing.

• • • •

Electric Service & Construction, Inc., Odessa, Tex., recently moved into its new shop which, according to owner Gayle Dishong, is "ultra-modern and designed for maximum efficiency and beauty".

• • • •

NISA won its second Certificate of Recognition in as many years with the entry of its Rewind Data File in the annual Awards Contest for Dis-



NEC PROBLEMS were discussed between sessions by Wm. J. Canada of Mountain Lakes, N. J., and Karl S. Geiges, Chief Engineer, Underwriters Laboratories, Inc., Chicago, during 30th annual meeting of Electrical Inspectors held this year at Atlantic City, N. J.

above all else

CUT OVERHEAD GLARE

specify...

marlou

"NEVA-GLARE"

LIGHTING FIXTURES

with Plexiglas Diffuser

Easy to install • Easy to clean and maintain

Solve your lighting problems with "NEVA-GLARE" fixtures—diffused, glare-free yet bright lighting, that makes for relaxed efficiency. You will know the moment you turn them on.

MARLOU'S new line of "Neva-Glare" Plexiglas units are ophthalmically designed to diffuse light evenly with an absolute minimum of light absorption. "Neva-Glare" fixtures are made to blend into the surroundings and the Plexiglas is easily removed for cleaning and maintenance, no tools required.

Available in square or rectangle units that are adaptable for flush or recessed installation. E.T.L. Curves on request

"Above all else...MARLOU is Quality Lighting".

Some select territories open to recognized Manufacturers Agents

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ARCHITECTS - BUILDERS

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FANWOOD, NEW JERSEY

A complete line of lighting fixtures for Fluorescent, Slimline and Cold Cathode Lights.

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AT LAST! Here is a single portable hydraulic bender that will handle ALL of your requirements . . . bends pipe, copper and steel tubing, rigid and thinwall conduit to 90° and 180° in one setting on the job.

A newly designed frame and hydraulic unit are quickly assembled to use for varied work. . . Fast! Accurate! Smooth! Saves cost of fittings and labor. (Patents Pending)

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Here's a Junction Box that fills the need for many underground wiring jobs. You can bring all your distant leads to this central point for splicing with wires from the control panel. Each conduit is sealed separately so that vapors cannot creep to switches. Simplifies wiring—Provides safety—Allows for instant accessibility for easy changes. Write for the Revere catalog today. It's filled with Units that will aid you in your work.

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THE COMPLETE LINE OF FLOODLIGHTS AND POLES FOR SERVICE STATION • SPORTS • AIRPORT • STREET • OUTDOOR THEATRE • MARINE AND INDUSTRIAL LIGHTING



TWO TEXANS who know every last splice and terminal throughout the electrical system at the Baytown-LaPorte, Tex., Tunnel are R. E. Dunbar (left) chief electrical maintenance engineer at the tunnel and Larry Schwing, superintendent for Muhl Electric Limited, Houston, electrical contractors who built the tunnel.

tinguished Service, conducted by the American Trade Association Executives. Last year, NISA entered NISA NEWS, then a new publication, in the contest, winning a similar award. The Rewind Data File, located in the Association's National Headquarters, contains more than 75,000 cards and is the largest collection of its kind in the world. The contest is designed to give recognition to the various services trade associations offer their members. ATAEE is an organization of trade association executives.

The first Association history, "Story of NISA," is being written by the Association's Director — Emeritus, Frank W. Willey, Willey-Wray Electric Co., Cincinnati. The author expects it to be completed early next year. The project, launched at the



ON THE JOB looking over the plans for the extensive electrical modernization and air conditioning of the Sam Houston Coliseum, Houston, Tex., are Ernest R. Keeton (left) president of Gulf Electric Company, Houston, and his general foreman on this job John W. Wilkinson.



ALBERT I. POZNER, president of Pozner Electric Co., New York, has been active in the industry for the past 25 years. He is currently devoting approximately 50% of his time to the rewiring of existing multi-unit apartment buildings for air conditioning and appliance loads.

Detroit Convention by NISA's Board of Directors, involves detailed research since much information—particularly that about NISA's early days—is unrecorded. Announcement of the availability of the history will be made when the final version of the manuscript is completed and approved.

• • • •

Clark Electric Motor Service, formerly located at 10701 Burbank Blvd., has moved to new quarters at 12734 Sherman Way, N. Hollywood, Calif.

• • • •

Joseph J. Muller, Industrial Electric, Inc., New Orleans was presented with a year's subscription to NISA NEWS for winning fourth place in the recent NISA International Open Golf Tournament, at the November 23 meeting of the New Orleans Chapter. The presentation was made by chapter



JUSTLY PROUD of almost half century of membership in the Western Section, IAEI is Harley R. Markel of Cincinnati, Ohio. A former electrical inspector, Mr. Markel joined the original Western Inspectors Association in 1905; is now active in the insurance and appraisal business in Cincinnati.

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NOW UP TO 600,000 CIRCULAR MILS!



AMP "SOLISTRAND" terminals, strongest and best of all non-insulated solderless connectors, are now available in wire ranges up to 600,000 circular mils! Patented AMP "W" Crimp unites all conductors into a homogeneous, corrosion resistant mass with the terminal barrel. Optimum electrical and mechanical performance is assured through AMP's pre-determined crimp formula. Short barrel lengths, brazed seam construction, and reinforced tongue, all contribute to make AMP SOLISTRAND terminals the outstanding permanent splice or connection for solid, stranded, irregular shaped, or combinations of these wire types.

AMP precision-engineered crimping tools are available for all wiring requirements. Each tool from the smallest hand tool to the powerful new DYNA-CRIMP pneumatic-hydraulic crimping unit (see below), is designed to produce uniformly high quality terminations with ease, precision, and efficiency. Write today for information and samples.

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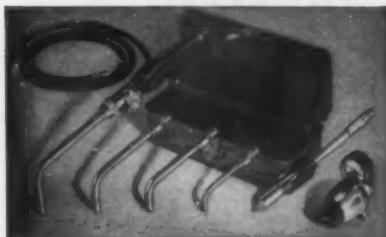
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PREST-O-LITE Torches average less than 12 in. long, weigh under 13 ounces. Precisely controlled flame heats only the work.



With the four different sized stems and soldering iron in this outfit, you can handle any job from the heaviest soldering down to finest instrument work. The stems and soldering iron are instantly interchangeable on a common handle. No wrench is needed. Every assembly is small, compact, light, and easy to handle in any location. See your LINDE Jobber today for details. Or write LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Division of Union Carbide Canada Limited, Toronto.

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10 SECONDS
CAN DO
FOR YOU

See Page 33

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PROMINENT HOUSTONIAN, Ernest R. Keeton, president of Gulf Electric Company, Houston, Tex., is an active, progressive factor in the development and growth of both the electrical industry in the Houston area and the Houston area itself.

president Seymour J. Stewart, S. J. Stewart (Electric), New Orleans.

The Buffalo Athletic Club, Buffalo, N. Y., was the scene of Niagara Chapter's dinner meeting November 12. G. E. Jones, NISA's president, and J. H. Hosmer, service engineer of Allis Chalmers Mfg. Co., were guests of honor. Hosmer spoke about what an independent service shop should do to maintain its place and continue as a successful enterprise in these times of ever increasing costs.

Approximately 50 members from the western and central sections of New York attended the meeting.

New England Chapter's regular meeting was held at Boston's Hotel Bradford October 14. Bernard M. Rosenberg, chapter secretary, led a forum on several questions selected from a list of questions given to the members. From the interest shown by the members it seemed obvious that this feature should be carried on each month for a minimum of 30 minutes.

Twelve members were present at the October 4 meeting of NISA's Northern California Chapter held at San Francisco's Olympic Club. Also present as guests of the chapter were Bob Crow and Charles Patton of Stockton Armature & Motor Works, Stockton. J. S. Van Alstyne, Van Alstyne & Son Electric, Sacramento, was appointed chapter reporter at this meeting.

The regular meeting of Quaker City Chapter was held on November 10 at Beck's-on-the-Boulevard with NISA's

president, G. E. Jones, among the guests. Other guests were members of the New York Metropolitan Chapter and Electric Motor Service Association of the District of Columbia.

Featured speaker was Marvin Brown of the Star-Kimble Division of Miehle Power Press Co. who spoke on the "Practical Aspects of Part-Winding Motor Starting."

• • • •

One hundred per cent attendance was reported at the October 12 meeting of Youngstown Chapter held at Colonial House, Youngstown, Ohio. At this meeting a motion was passed to assess each member \$50 per year to cover the cost of all monthly dinners. Any surplus after expenses have been paid will go to the chapter treasury to be used for any purpose which the members will decide.

Recently elected officers of the chapter are: president, Robert Cutler, Economy Electric Co.; secretary-treasurer, Frank Ortega, Frank's Electric Co.; chapter reporter, J. B. Winkle, J. B. Winkle Co.

• • • •

The regular monthly meeting of the Electric Motor Service Association of the District of Columbia was held October 25 at the Burlington Hotel. M. R. Whipple, chairman of the membership committee, gave a report from his committee on several new prospective members. Walter Bailey, gadget committee chairman, reported on several "gadgets" proposed to be used in motor shops. The meeting was at-



MORE THAN a quarter century of motor repair experience lies behind William T. Jacobson, owner of Electric Motor Repair in Sioux Falls, S. D. "Bill" envisions the time, not so far distant, when 3-phase rural lines will expand farm mechanization by permitting use of larger horsepower motors.

Crews that have a choice of all benders say Blackhawks are the handiest benders!



Here's another happy electrician! His handy Blackhawk Bender is so portable that he can even use it overhead on existing pipe runs. Any Blackhawk Bender, whether for thin-wall or rigid conduit, can be used on the bench or readily moved anywhere on the floor.



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because the Blackhawk "Porto-Power" remotely-controlled hydraulic jack operates in any position . . . on its side or upright . . . whichever way is easiest to measure the bend.



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because it's really portable. Is operated by convenient hand pump. The portable Blackhawk MOTOR-DRIVEN pump can be used for added speed and ease on big or repetitive bends.



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because you can simultaneously pump and "jockey around" to sight the job from the most desirable angle to assure kinkless bends, matched offsets and rigid installations.

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Example: Here is the S-30A kit for bending 1 to 2" rigid conduit. It contains powerful "Porto-Power" hydraulic jack and 9 bending attachments. The handy jack can also be used with other standard attachments to lift and settle machinery, align equipment, pull pulleys, etc. S-30A Kit complete, only . . . **\$135⁴⁵**
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Speed-minded contractors and crews are changing to BLACKHAWK
It's no secret that crews who have a choice of all types of benders prefer Blackhawk. Workmanship is far better and crews are kept happy.

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BENDERS FOR ALL WORK
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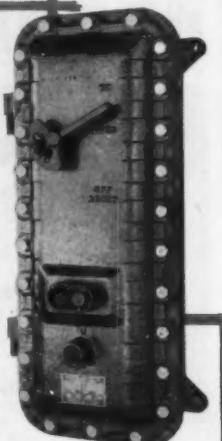
Plant modernization calls for electrical equipment of improved, up-to-date design.

Nelson motor starters can be furnished with extra interlocks, start-stop push buttons, selector switches, control transformers and other desired components. Special enclosures for watertight, dust-tight and explosion-proof service.

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NEW, fully-boxed, front cross-member adds to the carrying strength, rigidity and rugged endurance of the frame.

NEW, sturdier body design with sheet metal flanged and overlapped for extra strength . . . center mounted to relieve road strain and for even greater sturdiness.

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NEW, softer front seating is form fitting, bucket design with coil springing and gives a more comfortable ride.

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THE WORLD'S MOST USEFUL VEHICLES



SERIOUS TRIO in post-session discussion of hazardous-area wiring methods at Western Section, IAEI are (L to R): C. G. Teich, chief electrical inspector, Ames, Iowa; S. J. Rosch, Anaconda Wire & Cable Co., Hastings, N. Y.; and Fred Hintzman, REA inspector, Reynolds, Ind.

tended by at least one representative from all member firms.

• • • •

Great Lakes Chapter held its monthly meeting at Don Blackburn & Co., Detroit, November 8. NISA president G. E. Jones was a special guest at this meeting which was held a week earlier than originally scheduled to avoid conflicting with the opening of Michigan's hunting season. After the meeting a film was shown and a welding demonstration given by a local company which had developed a new welding process.

Chapter members were recent dinner guests of the Toledo Commutator Co., Owosso, Mich., and afterward were conducted on a tour of the company's plant.

Committee chairmen recently appointed by chapter president Charles E. Smith, J. E. Berger Corp., Detroit, are: program committee, Earl E. Kuchman, Detroit Electric Motor Works, Hazel Park, Mich.; by-laws committee, Edward Burke, Don Blackburn & Co., Detroit; friendship committee, Don M. Blackburn, of the same firm; audit committee, Marshall G. Pearce, Fife Pearce Electric Co., Detroit.

• • • •

The regular monthly meeting of Louisville Chapter was held at the Mayflower Dining Room on October 7. The members decided that the December meeting would be tape recorded and if the results of this experiment are successful the chapter will buy a tape recorder for permanent use. Chapter reporter George Ruf requests that any advice on pitfalls encountered by other chapter using tape recorders be forwarded to him at J. George Electric Co., 426 Baxter Ave., Louisville 4, Ky.

After the business meeting Dick Wade of E & H Electric Co., Louisville, showed his line of insulating materials to the group.

The third retired member to join the ranks of the newly-formed classification of "Privileged" member is L. H. Lanahan of Memphis, Tenn. Lanahan was vice-president and general manager of Tri-State Armature & Electrical Works until his recent retirement. He was president of the old Tennessee Chapter—now part of the Mid-South Chapter—and served it as a director. Privileged members are persons no longer actively engaged in the electrical repair business who once represented firms which were NISA members at least 10 years. R. A. Scherer of Indianapolis is NISA's first Privileged member and Frank T. Foshee of Houston, Tex., is No. 2. The classification was instituted at the Detroit Convention to permit persons once active in NISA to retain contact with the Association.

From Walter J. Prise, Queens Electric Motors, Inc., Jamaica, L. I., N. Y.

TVA Shows 26.9% Gain in Year

"Within the region served by TVA power, the demand for electricity has forged ahead with such rapidity that new generating capacity must be provided soon to meet the future power needs that are developing," the Tennessee Valley Authority says in its annual report to the President and the Congress for the fiscal year ending June 30, 1954.



NEBRASKA INSPECTORS at the recent Western Section IAEI meeting in Louisville, Ky., included: (L to R) R. Macfie, Omaha Public Power District, Omaha; L. S. Crain, chief electrical inspector, State of Nebraska, Lincoln; and Walter Farwell, rural inspector for the OPPD in Omaha.

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TO 5,000 VOLTS &
TO 2,000,000 CM!

AVA POWER CABLE BY CONTINENTAL WIRE

has long been known as one of the *highest rated temperature* cables made . . . Today, Continental AVA also supplies the *highest current capacities* in the industry (servicing from 600 to 5,000 volts) — and in the *widest range of sizes* available (18 AWG to 2,000,000 CM inclusive) . . . Write for stock-catalog, or about your particular requirements — special wires manufactured to meet specific conditions.

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Here's the vehicle that takes men and tools to the job when nothing else can—the all-new 4-Wheel-Drive 'Jeep'. With the extra traction of its 4-wheel-drive, the 'Jeep' goes through mud, sand, snow and roadless country . . . saves time when time counts most. It is good business to own the all-new 'Jeep' . . . and good insurance of getting through to the job every day in the year. Get all the facts about the all-new 'Jeep'.

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MODERN
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OPERATION

Couch

NON-CODE FIRE ALARM STATION

Here is an all new non-code UL approved fire alarm station for use in all types of buildings. Clean and simple in appearance, this station provides complete dependability of operation. Its two-position locking mercury switch element provides positive contact when operated, but is not affected by shock or vibration. The element is hermetically sealed for protection against dirt and moisture.

The photos at the right show the ease with which the station is reset after use. (Fig. 1) Station closed and about to be operated. (Fig. 2) Open station. (Fig. 3) Lift up sliding front panel. (Fig. 4) Replace glass rod (broken glass is self-clearing).

For complete details on this and other Couch fire alarm equipment write for Data Sheet FI

S. H.

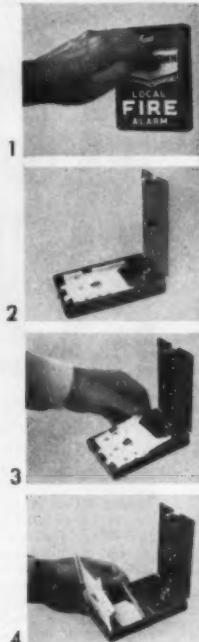


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Private telephones for home and office . . . hospital signaling systems . . . apartment house telephones and mail boxes . . . fire alarm systems for industrial plants and public buildings.

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CHECKING DETAILS of the extensive underground high voltage distribution system and interior electrical work at the Calliope Street Housing Project, New Orleans, La., are Harold Bartholomew (left) superintendent and Dan J. Duvoisin, president, Atlas Electric, New Orleans, electrical contractors on the job.



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Please send full details on the MASTER-TENNA system by RCA.

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The report disclosed that sales of electric power in the TVA power area increased 26.9% during the year but that use by agencies of the federal government, particularly the plants of the Atomic Energy Commission at Oak Ridge, Tenn., and Paducah, Ky., increased 69.4%.

These defense loads, TVA reported, amounted to 11.8 billion kilowatt-hours during the year and will grow to about 30 billion within the next two years. This is approximately equal to TVA's entire sales to all customers during fiscal 1954 and will amount to about half of the total power consumption in the entire Valley expected at that time.

"The generating capacity under construction will provide an assured load-carrying ability for the system of 9,443,000 kilowatts by the end of the calendar year 1956," the TVA report said. "This will enable TVA to meet the power demands of that time by only the narrowest of margins and it makes no provision for meeting the additional power requirements forecast for 1957 and 1958. At the end of 1956, the margin for meeting unforeseeable developments, affecting either TVA's generating capacity or now unpredictable demands for new blocks of power, will be dangerously small—in fact, only about half the average margin deemed advisable and being provided by the nation's private utilities."

According to the report, residential and farm sales hit 5½ billion kwh for fiscal '54, an increase of 14% over the previous year. The average customer used 4,734 kwh compared with a national average of 2,445 kwh.

Year Recorded New Power Records

According to a year-end report by Harold Quinton, president, Southern California Edison Co. and president of the Edison Electric Institute, 1954 was a notable year in the electric power industry.

The Diamond Jubilee year of the electric light marked 75 years of amazing growth and change since Thomas A. Edison's great discovery. The industry's 50 millionth customer was added in January. The five millionth farm was connected up for electric service a few weeks later. On the very anniversary day of the incandescent lamp, October 21, the country's 100 millionth kilowatt of generating capacity was put into operation at the St. Clair, Mich., plant of the Detroit Edison Company.

More generating capacity was added than ever in the country's history—11.5 million kilowatts of capability, well above the previous high of 10.1 million kilowatts in 1953. 1954 was the biggest output of electricity.

Ground was broken September 6 at Shippingport, Pa., for the nation's first full-scale power plant which will use atomic fuel. Duquesne Light Company will finance and build the generating portion of the plant, Westinghouse Electric Corp. will build the nuclear reactor under contract with the Atomic Energy Commission, and Duquesne Light Co. will operate it.

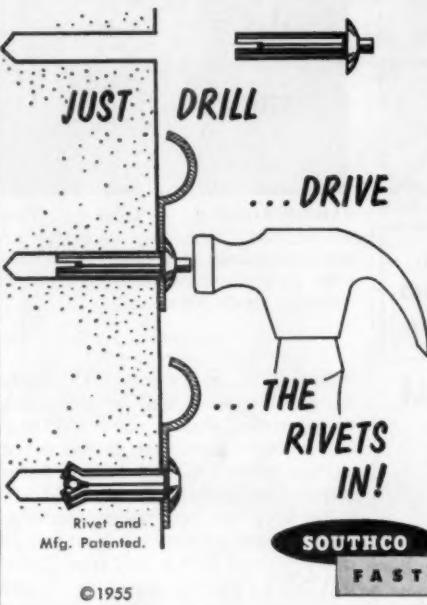
Many groups of power companies in different sections of the country, including the Pacific Northwest, were actively studying atomic power developments with a view to proceeding with such undertakings as fast as circumstances warrant.

The industry's Diamond Jubilee year also produced an extensive survey and forecast for the future which



CONGENIAL COMPETITORS are Columbus, Ohio, contractors E. E. Evans (left) who has been in the electrical construction business for 47 years; and V. H. Stanton, former chief electrical inspector for the city of Columbus and electrical code instructor. Both are proponents of good wiring standards and adequacy.

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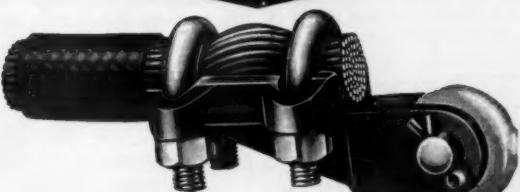
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Whenever two or more parts are fastened together.

LOCK CABLE SAFELY, SECURELY with "EFFICIENCY" Cable Strain Clamps

without Strain or Damage



... withstands direct pull of 17,000 pounds

Efficiency Cable Strain Clamps lock cable safely and securely without possible strain or damage. "H" construction of clamps and high ridge across center of cable prevents cable from slipping. Takes cable from 1/0 to 1,500-000 c. m. Three clamp sizes cover all cable sizes. Furnished with eye or clevis, for AC or DC service.

Write for Catalog 38-A



How to handle wiring and installation jobs . . .

in strict
accordance
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No need to waste time puzzling over National Electrical Code rules! You can get their EXACT meaning—how they apply to the job you're doing—quickly and easily with this practical handbook. Explains the rules in simple, clear language—and uses diagrams, tables, and photographs to make sure you grasp every essential point.

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KENTUCKIANS J. H. Meglemry, Tafel Electric Co., Louisville, and electrical contractor Charles E. Bottorff, Goshen, enjoy light conversation during Louisville inspector meeting recess.

indicates that by the year 1965 demand for electric power will be double that of today, and that by 1975 a three- or even four-fold increase in the use of electric energy by the homes, farms, stores, and factories is expected.

To keep up with increasing electrical demand, the survey indicates the industry must plan to add from 7,000,000 to 12,000,000 kilowatts of new generating capacity each year between now and 1965. After 1965, the requirements for new capacity to take care of load growth may be from 11,000,000 to 24,000,000 kw. a year.

The survey estimated that generating plants using atomic energy as fuel will total one to two million kilowatts of capacity within the next ten years, and that by 1975 we might have from 40 to 65 million kw of atomic power plants, of an expected 301 to 423 million kw of generating capability.

Average consumption of electricity in the home increased by 194 kWhr per domestic customer, the largest annual gain on record. Total average use by the householder was 2540 kWhr for the year. Sales to domestic customers alone in 1954 were greater than the total sales to all classes of customers only 15 years ago.

Use of electricity by domestic consumers now accounts for 26.4% of all electricity sales. The continually increasing importance of electric service in the home is indicated by these comparisons: In 1946, the percentage was 20.2. Twenty-five years ago, domestic sales were 13% of the total sales, or one-half the present percentage.

By the end of 1954, an estimated 5,090,000 farms had electric service, 94.6% of the over-all farm figure. All but 2% of the nation's occupied farms now either have electric service or have it readily available.

Slash Motor Maintenance
Speed Installation
Increase Brush Life
Cut Motor Down Time



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... really protect your motor and generator investments. Engineered for better contact and reduced vibrations, Helwig Multiflex brushes eliminate uneven wear and reduce circulating current. Get multiple brush operation without expensive changes. The key to longer commutator life is a quality brush designed to FIT, instead of a cut-down, so-called standard brush. Save production time and money with Helwig tailor-made brushes. Write for details on the Helwig brush inventory control plan.

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EEI Booklet on the Electric Industry

Electricity sales, which have doubled during the last ten years, are expected to register a similar gain by 1965, with anticipated population growth, improved living standards, and industrial advances requiring large amounts of power as contributing factors, according to the 1954-1955 edition of "I Want to Know About the Electric Industry", a booklet just published by the Edison Electric Institute, New York City.

This year's edition discusses in some detail the industry's record growth in recent years, the financial investments which made this growth possible, and future prospects for continued expansion, extending as far ahead as 1975 and including a discussion of the possibilities of a transition from the use of ordinary fuels to nuclear energy in the production of electricity.

The seventh in a series begun in 1948, the booklet is presented in the form of 28 questions frequently asked about the electric industry, ranging in subject from "How Does the U. S. Rank in World Production of Electricity?" and "How Fast is the U. S. Moving in Production and Capability?" to "How Many Customers?" and "How Much Fuel Is Used in Electricity Production?" The use of electricity in the home, on the farm, and in industry and commerce, source and disposal of electric company revenues, steam plant and water power installations, and ownership trends of generating installations are also discussed.

Answers to the questions are in text-and-table form, derived from such sources as the EEI's annual Statistical Bulletin and various Federal Power Commission publications.



WEST VIRGINIANS at Louisville, Ky., meeting of western inspector group include (L to R): Fred P. Oliver and David Gorrell of Gorrell Electric Co., Parkersburg electrical contractor; and Robert E. Wilson, West Virginia Inspection Bureau, Charleston.

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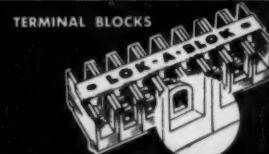
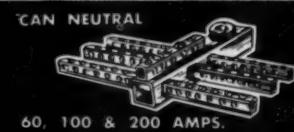
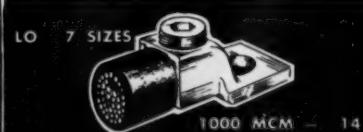
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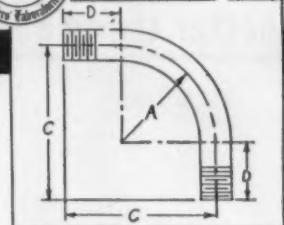
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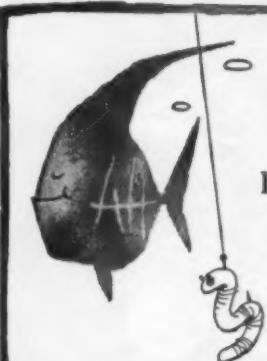
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DATES AHEAD

Plant Maintenance & Engineering Show—International Amphitheatre, Chicago, Ill., January 24-27.

International Heating and Ventilating Exposition—Commercial Museum and Convention Hall, Philadelphia, Pa., January 24-28.

National Industrial Service Association—Eastern Regional Conference, Southern Hotel, Baltimore, Md., January 29.

American Institute of Electrical Engineers—Winter general meeting, Hotel Statler, New York, N. Y., January 31-February 4.

Power and Communications Contractors Assn.—10th annual convention, Roosevelt Hotel, New Orleans, La., February 2-4.

National Rural Electric Cooperative Assn.—Annual meeting, Atlantic City, N. J., February 14-17.

National Adequate Wiring Conference—11th annual conference, LaSalle Hotel, Chicago, Ill., February 24-25.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 13-18.

Illuminating Engineering Society—Regional Conferences (1955): Southern—Fort Harrison Hotel, Clearwater, Florida, March 31-April 1; Southwestern—Gunter Hotel, San Antonio, Texas, April 3-5; Inter-Mountain—Phoenix, Arizona, April 11-13; South Pacific Coast—Statler Hotel, Los Angeles, California, April 14-15; Pacific Northwest—Harrison Hot Springs Hotel, Harrison Lake, British Columbia (Canada), April 25-26; Midwestern—Edgewater Beach Hotel, Chicago, Illinois, May 2-3; Canadian—Mount Royal Hotel, Montreal, Quebec (Canada), May 12-13; East Central—Abraham Lincoln Hotel, Reading, Pennsylvania, May 19-20; and Northeastern—Fort William Henry Hotel, Lake George, New York, June 10-11.

Chicago Electrical Industry Show—Third biennial exhibit sponsored by the Electric Association of Chicago in cooperation with the Electrical Maintenance Engineers of Chicago, Conrad Hilton Hotel, Chicago, Ill., May 10-12.

Pacific Coast Electrical Association, Inc.—Annual convention, Palace Hotel, San Francisco, Calif., May 11-13.

National Fire Protection Assn.—59th annual convention, Netherland Plaza Hotel, Cincinnati, Ohio, May 16-20.

National Industrial Service Assn., Inc.—Annual convention, Hotel Statler, Los Angeles, Calif., June 5-9.

Illuminating Engineering Society—National Technical Conference, Statler Hotel, Cleveland, Ohio, September 12-16.

International Association of Electrical Inspectors—Western Section, annual convention, Hotel Nicollet, Minneapolis, Minn., September 26-28.

Among the Manufacturers

Headquarters Announcements

BullDog Electric Products Co., Detroit, Mich.—Hugh V. Diamond, Jr., sales and product counselor.

Homelite Corporation, Port Chester, N. Y.—R. C. McDonald and Albert K. Newman, vice presidents.

Graybar Electric Co., Inc., New York, N. Y.—Douglas Wallace, assistant vice president.

ACEC Electric Corporation is the new name of the Belgian Electric Sales Corp., New York, N. Y.

Holden Line Co., Cleveland, Ohio—Ellsworth M. Smith, president; Earl R. Earnest, executive vice president of the new management.

General Electric Co., Schenectady, N. Y.—Major changes at the executive office level include: formation of a Distribution Group consisting of the Apparatus Sales Division, G. E. Supply Co., International G. E. Co. and the G. E. Credit Co.; inclusion of the Canadian G. E. Co. into the Apparatus Group; inclusion of the X-Ray Dept. under the Industrial Products and Lamp Group. Executive vice president Henry V. Erben will head the Distribution Group with executive vice president Robert Paxton taking over the Apparatus Group and newly elected John W. Belanger becoming executive vice president of the Industrial Products and Lamp Group.



UNIFORM WIRING regulations is the subject of this informal conference between Henry R. Dreher, engineering and safety regulations section, NEMA, New York; and E. H. Rueppel, (right) chief, Kentucky State Electrical Inspection Bureau, Louisville.

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37	2	1800	33.25
12	3	1800	36.75
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10	7 1/2	1800	57.40
55	10	1800	72.80
3	15	1800	87.50
5	20	1800	115.15
7	25	1800	135.45
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W. J. INDSETH, president of State Electric Service, Inc., Huron, is among the younger contractors in South Dakota. He started the company with his brother in 1947; has charge of construction activities which cover an area within a 50-mile radius of Huron.

Lightolier, Inc., Jersey City, N. J.—E. H. R. Blitzer, managing vice president; William Blitzer, a director.

U. S. Hoffman Machinery Corp., New York, N. Y.—R. L. Stephenson, vice president of the new Industrial Equipment Division manufacturing air appliances and industrial filtration equipment.

Sun Chemical Corp., Long Island City, N. Y.—Walter F. Hugger, general sales manager of Electro-Technical Products Div.

Formsprag Co., Van Dyke, Mich.—L. B. Zaremba, production manager.

Nickel Cadmium Battery Corp., Easthampton, Mass.—Grenville B. Ellis, executive vice president.

Minnesota Silicone Rubber, Inc., St. Louis Park, Minn.—E. Burke Neff, vice president and general manager.

Square D Company, Detroit, Mich.—Mitchell P. Kartalia, manager of distribution equipment sales.

Penn-Union Electric Corp., Erie, Pa.—Chester C. Boesewetter, chief engineer.

General Electric Co., Pittsfield, Mass.—Joseph W. Seaman, general manager, Power Transformer Dept.

Kuhlman Electric Co., Bay City, Mich., has acquired the State Metal Fabricators, Inc. of Salinas, Calif. which will operate as a Western Div. plant producing distribution transformers.

Appleton Electric Company, Chicago, Ill.—I. W. Strong, assistant to the president in charge of sales.

Regional Appointments

NEW ENGLAND

Hubbard and Co.: John E. Wengle, division sales manager for New

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The Where-To-Buy Section of Electrical Construction and Maintenance supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue—a good habit!

England, New York and parts of New Jersey; J. J. McQueeny, New England district manager.

MIDDLE ATLANTIC

Pittsburgh Standard Conduit Co.: James F. Davis, sales manager of Morrisville, Pa. Division supervising sales in greater New York and New Jersey.

Markel Electric Products, Inc.: John H. Vier, sales representative for northeast Pennsylvania, northern New Jersey and metropolitan New York.

Graybar Electric Co., Inc.: J. E. Carroll, Pittsburgh district manager.

SOUTH ATLANTIC

Electro Silv-A-King Corp.: Perry G. Sessions, Jr., district manager for Georgia, northern Alabama, central Tennessee and western South Carolina.

Keystone Mfg. Co.: Thomas Quilter, Florida representative.

EAST CENTRAL

Mycalex Corp. of America: Leslie F. Thompson, manager of new Chicago office serving Illinois, Indiana, Iowa and eastern Wisconsin.

Trombetta Solenoid Corp.: Howard Odoms, manager of new district office in Milford, Ohio.

Sola Electric Co.: R. R. Marchetti, district sales engineer for Cleveland-Detroit area.

Allis-Chalmers Manufacturing Co.: Norman L. Danforth, Toledo, Ohio, district manager.

K S M Products, Inc.: Claude Batuk and D. C. Rolling, district engineers for Chicago and Detroit areas.

WEST CENTRAL

Penn-Union Electric Corporation: Frank C. Clatterbaugh, sales representative for Nebraska and Iowa.

Marvin Manufacturing Co.: B. L. Cook, Texas and Oklahoma representative, office in Houston.

Federal Pacific Electric Co.: A. E. Johnson, manager of new sales office in Minneapolis, Minn.

Tomic Sales & Engineering Co.: Lucius L. Dailey, district sales manager for the Southwest; Tom Harrison, representative for Oklahoma, northern Texas and Shreveport, La.; Bob Roberts, southern Texas representative and E. J. Hagen, representative for Louisiana, Mobile, Ala. and Pensacola, Fla.

WEST

Feedrail Corp.: Eichorn and Melchior, representatives in San Francisco.

Mycalex Corp. of America: Kenneth V. Tindall, manager of new Los Angeles, California office.

Fluorescent Fixtures of California: Joseph R. Ray, sales engineer for Utah, Colorado, Kansas and Missouri.

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For Sale 203

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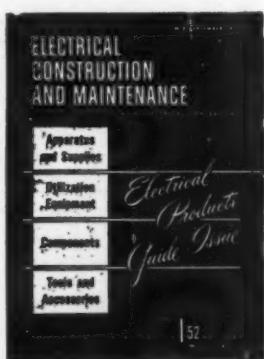
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listed their products in

ELECTRICAL READING

Electrical Products Guide

For complete information, and application on their lines, refer to the Index of Manufacturers in the **ELECTRICAL PRODUCTS** . . . the 13th issue of **ELECTRICAL CONSTRUCTION AND MAINTENANCE**.



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**Here's the best way to prove that
NEW G-E WHITE IS EASIER TO BEND**

Every time you bend or thread new G-E white conduit, you'll prove to yourself that metallizing makes your job easier. Metallizing is a completely different galvanizing process that permanently bonds a uniform coating of pure zinc to the entire exterior of the conduit, even the threads. The excessive heat, quenching, and straightening used in other galvanizing processes are eliminated with metallizing. The result is a more ductile conduit that is easier to handle.

EASIER THREADING. Metallizing produces a unique zinc structure that acts as a lubricant for cutting tools. Threads are easier to cut right on the job.

EASIER FISHING AND WIRE PULLING. New G-E White has a tough, corrosion-resistant, organic coating tightly bonded

to the inside of the conduit. This coating contains an anti-friction agent that permits conductors to slide through the conduit easily, thus cutting fishing and wire-pulling time and effort.

BETTER CORROSION RESISTANCE. Metallizing, covered by a tough coating of C-553 lacquer, produces a conduit that has been proved exceptionally resistant to smoke, heat, humidity, acid fumes, alkalies, and salt atmospheres.

New G-E white conforms to all Federal Specifications, American Standards Association Specifications, and is listed by Underwriters' Laboratories, Inc. Ask your distributor for more information or write
Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

GENERAL  **ELECTRIC**

